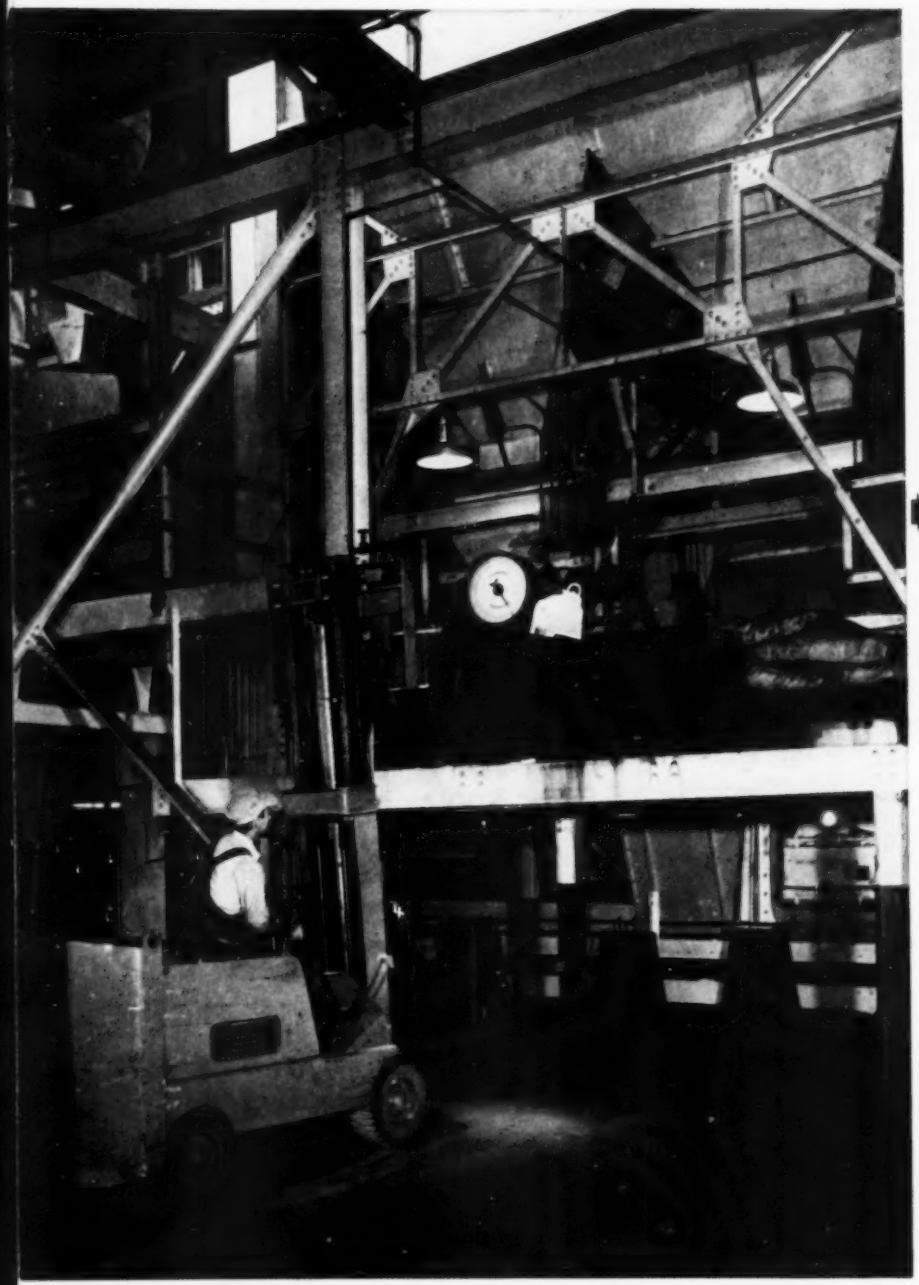
Industry and Power



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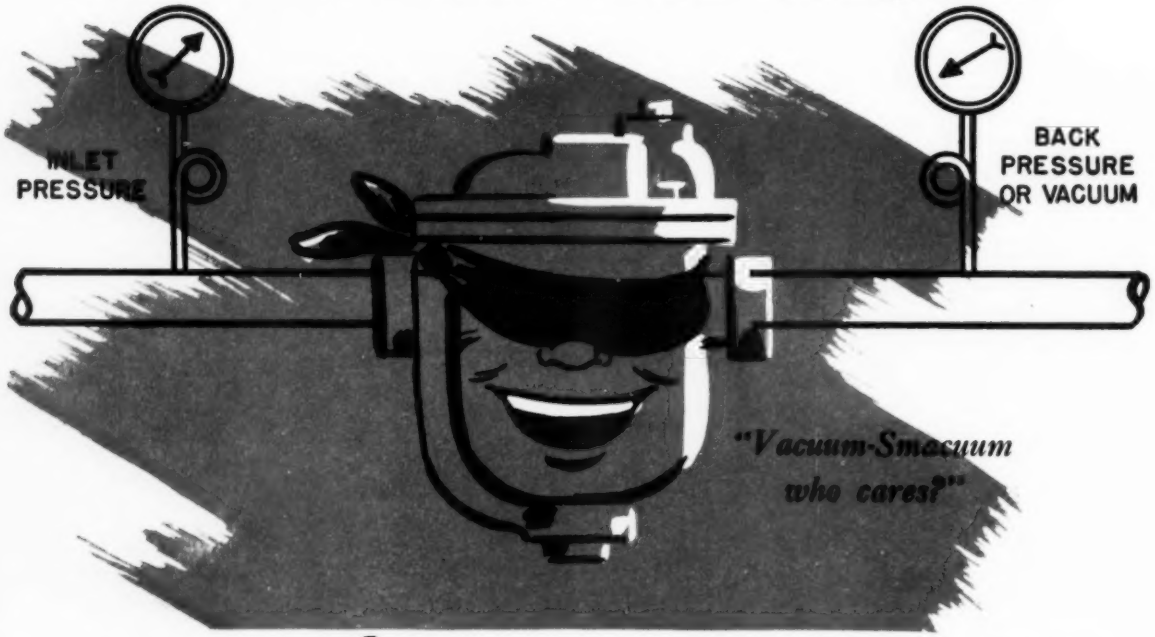
for engineers and engineering executives responsible for

— engineered plant facilities

VACUUM ISN'T VACUUM
TO A STEAM TRAP

. . . It's Just Pressure Below Atmospheric



ONLY 2½¢ per year per trap parts costs on traps averaging 11 years of service at Globe Steel Tubes Company, Milwaukee, Wisconsin.

PRACTICALLY ZERO maintenance, complete satisfaction with traps after 12 years service on 10 lbs. pressure, 5" vacuum—Liquid Veneer Corp., Buffalo, N.Y.

***Send for 4-page Bulletin No. 223, "Vacuum Isn't Vacuum"—a complete discussion of vacuum, effect on trap selection, causes of vacuum loss, effect of flash steam, etc. Free on request. Just fill in and mail the coupon.**

BUYERS are sometimes told that steam traps for vacuum return service must be "different"—requiring, we suppose, some mysterious ability to recognize vacuum and act accordingly.

The truth is that vacuum isn't vacuum to any steam trap. It is just pressure below atmospheric pressure. All vacuum does is increase the pressure differential across the trap orifice. An Armstrong trap doesn't care whether it discharges to vacuum, back pressure or atmosphere. It works just the same in all cases.

Because Armstrong traps don't have to wait for condensate to cool, drainage is fast and equipment temperatures and BTU output are maximum.

Armstrong traps won't cause you to lose vacuum. Any flash steam from their discharge is quickly condensed. *It is the leaky traps that make it hard to hold vacuum!*

The mechanisms in Armstrong traps for low pressure vacuum return service are identical in design, workmanship and materials to those used in traps for 900°F, 950 lbs. pressure. They can't help but operate a long, long time without leaking. This makes it nice for the maintenance man, too.

Fast heat-up, high temperatures, low maintenance, long life—all wrapped up in one package. Ask your Armstrong Representative to go over your vacuum heating system with you.

ARMSTRONG MACHINE WORKS
820 Maple St., Three Rivers, Michigan

ARMSTRONG MACHINE WORKS
820 Maple St., Three Rivers, Michigan
Please send Bulletin 223, "Vacuum Isn't Vacuum"

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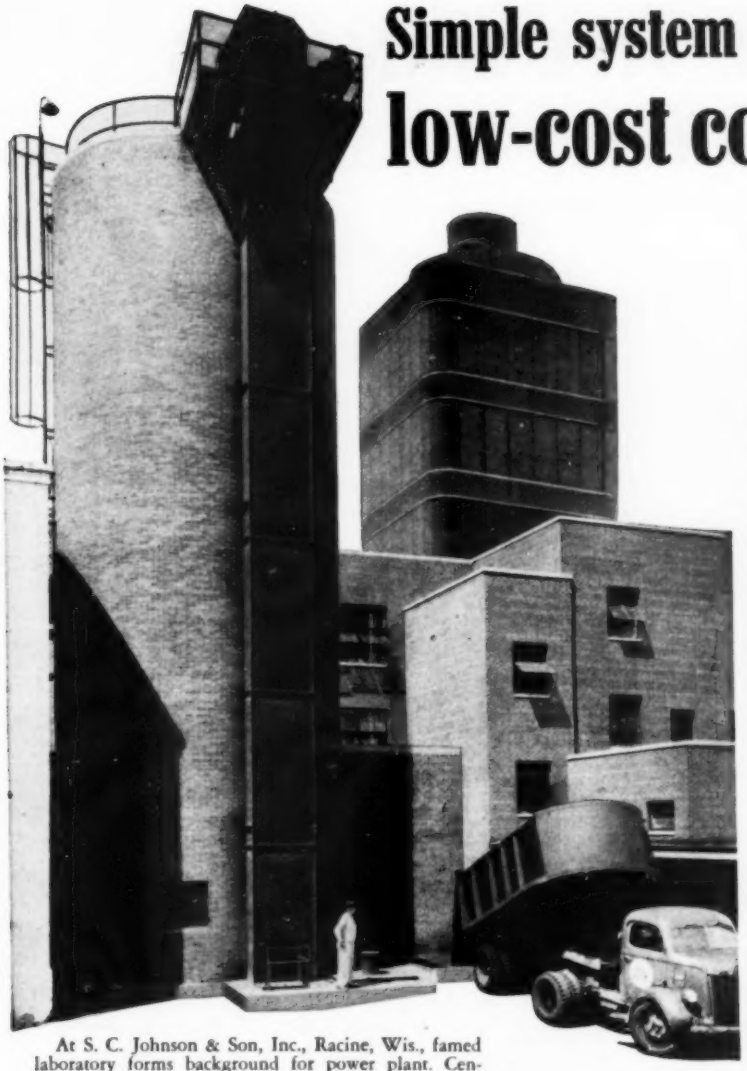
Simple system spells low-cost coal handling for small power plant



At S. C. Johnson & Son, Inc., Racine, Wis., famed laboratory forms background for power plant. Centrifugal discharge bucket elevator handles 40 tph.

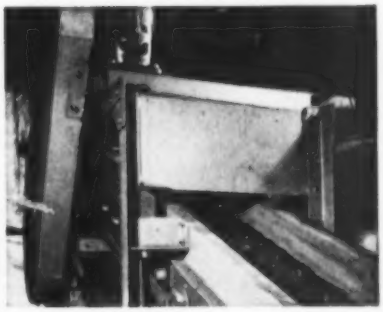
LINK-BELT equipment at S. C. Johnson & Son, Inc. provides clean, efficient operation

THE compact, economical coal handling provided for the makers of Johnson's wax is typical of hundreds of Link-Belt power plant installations. Large or small — your plant, too, can get the added efficiency of modern, mechanized equipment.

Link-Belt's experience is based on years of success in meeting every type of coal handling problem. This vast background, combined with a complete line of coal handling equipment, is your assurance of a system that's right for your needs. And Link-Belt's quality products have earned a reputation for dependable, long-life service. See your nearest Link-Belt office for a copy of Book 2410, showing many typical, modern power plant layouts.

LINK-BELT
COAL HANDLING EQUIPMENT

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle; Scarboro, Toronto and Elmira, Ont. (Canada); Springs (South Africa); Sydney (Australia). Sales Offices in Principal Cities. 13.320



Apron conveyor loads bucket elevator. Live or dead storage is fed by elevator.

From elevator, coal is moved by 12 in. screw conveyor atop storage silo.

Weigh larry delivers coal from discharge chute to three stoker hoppers.

ADJUSTABLE PIPE HANGERS AND SUPPORTS

for every piping requirement

NO. 5 OF A SERIES SHOWING THE GRINNELL LINE

SOCKETS
COUPLINGS
TURNBUCKLE

Socket only for split ring fig. 110R 3/8 to 3/8 in. rod

Weldless eye nut fig. 290 3/8 to 1 1/2 in. rod

Forged steel clevis fig. 299 3/8 to 1 1/2 in. rod

Turnbuckle drop forged steel fig. 230 3/8 to 1 1/2 in. rod

Rod coupling fig. 136 3/8 to 3/8 in. rod

Adj. swivel coupling fig. 134 3/8 to 3/8 in. rod

Turnbuckle adjustor fig. 114

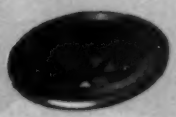
Rod coupling fig. 208 toggle bolt fig. 209 3/8 to 3/8 in. rod

U-HANGERS
EXTENSION
CEILING PLATE

Standard U bolt fig. 137

Adj. wrought U pipe hanger fig. 252 3/8 to 3/8 in. rod

Extension piece fig. 157 3/8 to 3/8 in. rod


Spring Ceiling plate fig.133 3/8 to 3/8 in. rod

ASSEMBLIES

Split ring with socket and coach screw

Split ring, socket and ceiling flange

Extension split ring hanger fig. 139

Adj. swivel ring with coach screw fig. 100

Adj. clip hanger fig. 104

Call your local Grinnell Distributor, or write for Hanger Catalog.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
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BIG NEWS!

Both *Inch-Pound* and *Foot-Pound* Models of Amazing PROTO Torquer Now Available!

Announced in January! Over 30,000 bought by March 31!! That's the whirlwind success story of the sensational PROTO torque-*limiting* wrench. In addition to foot-pound models, you can now buy *inch-pound* styles with all of the features that made the Torquer famous overnight. Thousands of jobs can now be handled with the various inch-pound and foot-pound capacities, different drive sizes and plain or ratchet head styles available. Whether used for repair, assembly, inspection or installation work, the super-fast Torquer pays for itself in time saved. Buy the model you prefer from your PROTO dealer today! Send 10¢ for 68-page catalog of entire line to

PLOMB TOOL COMPANY
2276Z Santa Fe Avenue, Los Angeles 54, Calif.

Fastest Torquer in the World!
* Automatic Torque-Limiting Release
* NO Dials, Scales or Pointers to Watch or Break
* Ratchet Head Models Save Time
* Use in Dark, Noisy or "Blind" Locations
* Enclosed Precision Spring and Accurate Micrometer-Type Adjustment
* All-Steel Trouble-Free Construction

5383

PROTO TOOLS

Eastern Factory—Jamestown, N.Y.
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acorns

. . . recently announced . . . worth watching

Sonic Pumps

● Sound waves are lifting hundreds of barrels of oil a day out of oil wells. Sending sonic wave energy down a tube operates the acoustic pump at 10 strokes per second.

Casting Titanium

● Titanium can now be cast into complex shapes weighing several pounds. This has been made possible by the development of vacuum melting furnaces, casting procedures, and mold materials capable of coping with attack by the molten titanium. Pilot quantities of pure and alloyed titanium castings are presently available. Carbon, oxygen, and nitrogen content are comparable with commercially available wrought titanium; surface quality is equal to that of good quality sand castings.

Dirt Improves Grease

● New thickening agents for petroleum greases bear a striking resemblance to dirt—certainly the last thing one would put into a bearing. However, thickeners made of silica compounds, colloidal Fuller's earth and other similar materials have been found to have excellent gelling properties when properly dispersed in lubricating oils. The thickeners are worked into extremely finely divided particles and are refined to remove all abrasive materials. Because the resulting lubricants have the ability to stand up under such a widely extended range of operating conditions, it is expected the new thickeners will permit a few multipurpose greases to replace the myriads now required for many operating environments. The new types impose the same wear on bearings as conventional greases. A grease using the colloidal Fuller's earth is expected on the market soon; it is predicted it will give excellent corrosion protection and resist breakdown by oxidation.

Tinning Oils

● Domestic fats can now replace imported palm oils as the base for tinning oils used in hot-dip tin plating of sheet steel. An inexpensive process has been developed which hydrogenates, deodorizes, and stabilizes lard, tallow, white grease, and other animal fats. The process makes them equal to the palm oil in every respect and in some ways superior.

Settling Slurries

● An automatic recording mechanism for measuring sedimentation rates has been developed; its chief advantage over conventional equipment is its automatic operation. The device also indirectly indicates the particle size distributions in the slurry. With proper operating precautions, it is expected that the device will permit study of slurries at elevated temperatures.

Radiation and Combustion

● Previous reports to industry that radioactivity improved diesel engine performance have been nullified by more recent information of studies using greater radiation intensities than first employed. Studies of diesel combustion in the presence of increased radiation showed little influence of radiation on engine performance. Similar studies of jet burners gave similar results.

Soldering Techniques

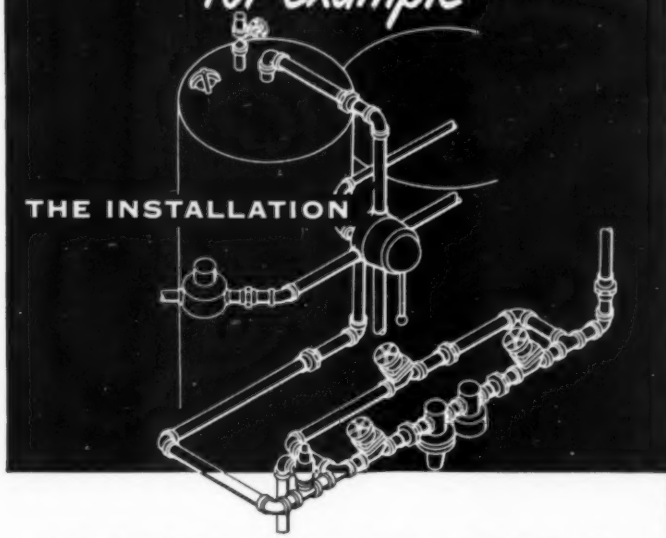
● A new hot-dip soldering technique has been announced for joining aluminum, beryllium, zirconium, uranium, tungsten, or aluminum-lithium alloy to copper or some other metal plate. The metal to be soldered is tinned by dipping through a molten flux into molten solder of proper composition. Standard torch or soldering iron techniques follow.

Turning Back Heat

● A heat insulating material which can be sprayed on metal like paint has been developed which will withstand temperatures as high as 5000 F. A coating 1/16-in. thick protects metals for as long as 10 seconds against flame temperatures hotter than the melting temperatures of the metal. The inorganic water-base material is nontoxic, nonflammable, nonexplosive, and requires no sandblasting or priming—just a clean metal surface—for any application. Modified versions are contemplated for wide industrial use which will adhere to many types of surfaces, withstanding water, acids, alcohol, and weathering.

This Valve Stops the "Up" in Upkeep ...on Water Service Piping,

for example



At the Excello Paper Products Co., Inc., Cincinnati, using Crane Diaphragm valves on city water supply lines; also on plant service water piping, hot and cold.

VALVE SERVICE RATINGS

SUITABILITY:
Doing what other valves couldn't

FEATURES:
Packless - Long Life Diaphragm

MAINTENANCE COST:
No regular maintenance needed

SERVICE LIFE:
Outlasting other valves many times

OPERATING RESULTS:
Safety hazard to personnel stopped

AVAILABILITY:
Crane catalog item - No. 1610

THE CASE HISTORY

Typical of many processes using a lot of water, this plant has numerous open end lines and hose connections. And because of very frequent operation, the valves formerly used in these lines required more than usual servicing to keep up with leakage, dripping hose lines, and hazardous, messy floors.

Crane No. 1610 Diaphragm valves were selected to replace the troublesome conventional valves. Immediately these packless valves stopped the annoyance and expense of stuffing box and seat leakage. Their pliable disc insert ring made a tight seat on open end lines with minimum effort on handwheels.

The replacements were started about 2 years ago. With no attention whatsoever, all Crane Diaphragm valves remain tight, and the plant's water leakage problem remains solved.

THE VALVE

Water is but one of hundreds of fluids Crane Packless Diaphragm valves handle efficiently. Their sealed-to-fluid bonnet and "soft-seating" disc are ideal for all sorts of hard-to-hold liquids and gases; also for sludges, slurries, etc. Separate disc and diaphragm design saves diaphragm wear; permits tight seating even should diaphragm fail. Choose these valves from a wide range of materials, lined or unlined body, for corrosive or ordinary applications. See your Crane Catalog, or your Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

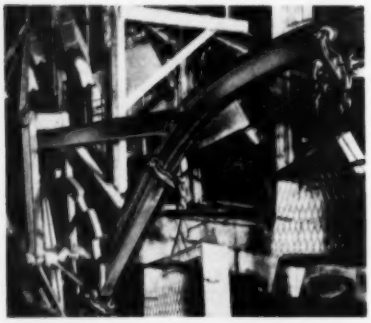
CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

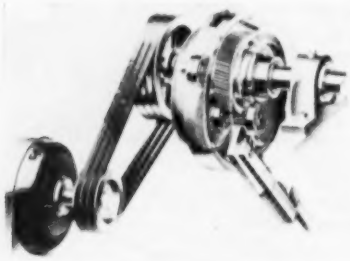
new equipment

. . . new developments



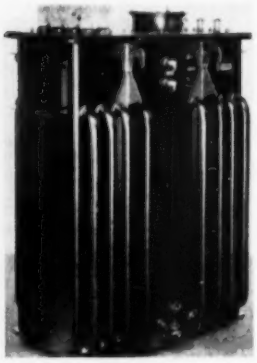
Efficient materials handling possible with cable system

J10 Simplicity, flexibility, and economy are features of the Cable-Link Conveyor Systems, according to the manufacturer, Cable-Link Corp. Lengths of 16, 24, and 32 in. improved, plow steel cable with steel buttons swaged on the ends make possible light trolley assembly. Buttons join in a forged steel bracket. Nuts threaded on the bracket sleeve exert 360 deg pressure on the cable to retain the trolley at an immovable station. Suspended load capacities range from 80 to 500 lb per station with pull loads per drive of 1500 to 4000 lb. Model C-L 120 operates on a 2 in. tee rail or split 6 in. junior I-beam. Models C-L 130 and C-L 140 operate on 3 and 4 in. I-beams respectively. Applications are given in a 6-page bulletin.



Speed reduction units available in 13 to 1 ratio

J11 Shaft-mounted speed reduction units in a 13 to 1 ratio, added to the line of American Pulley Co., extend the advantages of V-belt drives to a wide variety of slow-speed equipment. Adaptable to shaft-size up to 3 15/16 in., the reducers require only standard shaft lengths to be mounted directly on the shaft of the machine. Features include a leak proof, antifriction, oil sealing system, interchangeable split tapered bushings, and both tapered roller and ball bearings.

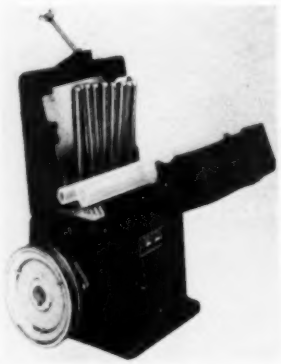


Transformer simplifies inspection

J12 Ease of inspection and replacement are features of a pre-assembled distribution transformer unit which can reduce labor costs, afford greater safety to personnel, and reduce wiring expense according to the manufacturer, Pennsylvania Transformer Co. Known as the Power Pack Assembly, it is designed for either single or multiple customer service and can be installed in a relatively small space in buildings, sidewalk vaults, or out-of-doors. Three phase service for 150, 225, and 350 kva, and a combination of three phase and single phase service with ratings of 100 and 200 kva are available.

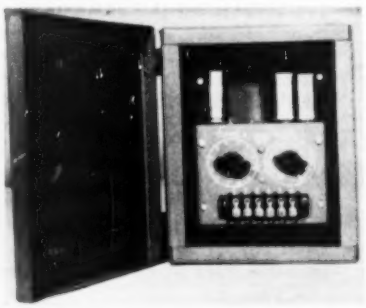
Control thermometer features low cost

J13 Automatic control advantages for manually regulated processes are provided by an indicating, pneumatic control thermometer, according to the Industrial Div. of Minneapolis-Honeywell Regulator Co. The low cost controller, with either direct or reverse-acting on-off or limited throttler control, is actuated by standard vapor- or mercury-filled thermal systems. A bulletin gives further information.



Material pumped through flexible tubing

J14 Liquids and gases can be pumped from one container to another by placing the connecting flexible tubing in a pump manufactured by Sigmamotor, Inc. The material is forced through tubing up to 1 in. dia by the pressure of steel fingers. Fluids can be handled, during one operation, in proportion, simultaneously, or independently through different size tubing. The unit carries 45 to 250 gph at 500 rpm.



Electronic timer features reliability

J15 An enclosed electronic unit has been developed by G. C. Wilson & Co. for applications that require timed intervals, time delay periods or other programming. Known as the type 60 MC timer, it is not affected by

(Continued on page 12)

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Insert this number on return post card on page 123.

JENKINS PRACTICAL PIPING LAYOUTS

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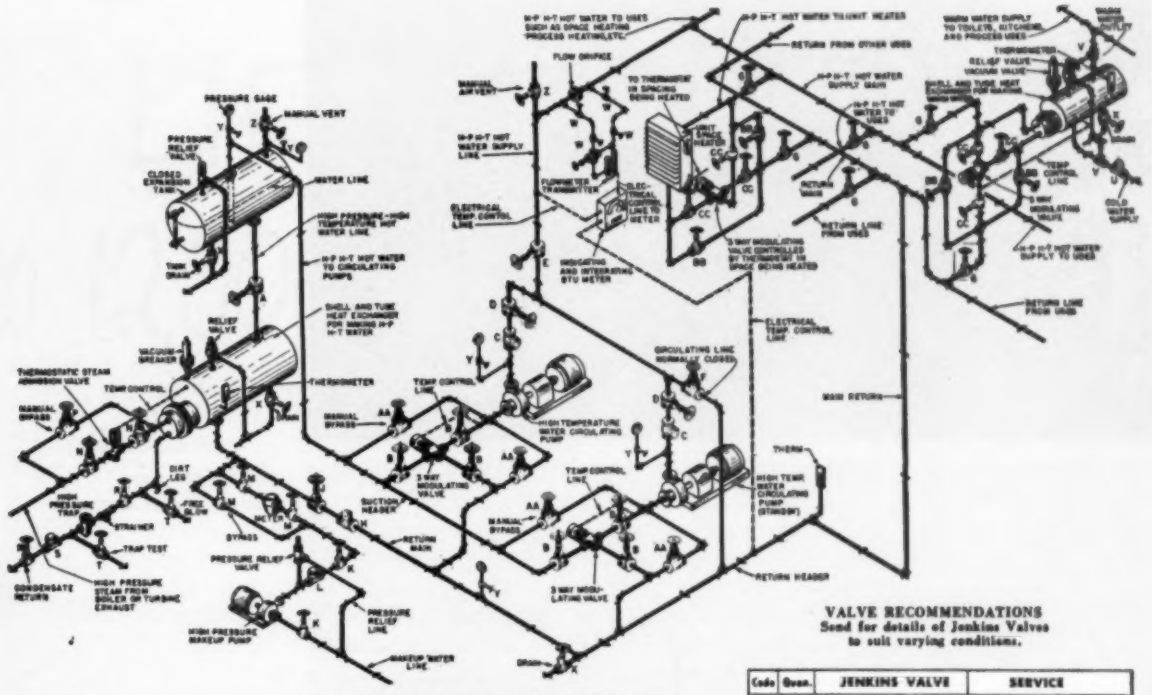

Diagram by Huxley Madeheim, Consulting Engineer
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VALVE RECOMMENDATIONS
Send for details of Jenkins Valves to suit varying conditions.

Code	Quan.	JENKINS VALVE	SERVICE
A	1	Fig. 204 188M Gate	HP-HT Hot Water Shutoff
B	6	Fig. 204 188M Gate	3 Way Valve Shutoff
C	2	Fig. 339-R 188M Swing Check	Prevent Backflow
D	2	Fig. 204 188M Gate	Pump Discharge Shutoff
E	1	Fig. 204 188M Gate	Supply Line Shutoff
F	1	Fig. 923 188M Globe	Circulating Line Shutoff
G	6	Fig. 280 Bronze Gate	Branch Shutoffs
H	1	Fig. 339-R 188M Swing Check	Prevent Backflow
J	1	Fig. 204 188M Gate	Return Main Shutoff
K	2	Fig. 280-U Bronze Gate	Makeup Pump Shutoff
L	1	Fig. 962 Bronze Swing Check	Prevent Backflow
M	3	Fig. 280 Bronze Gate	Makeup Meter Shutoff
N	2	Fig. 1010 Cast Steel Gate	Thermostatic Valve Shutoff
P	1	Fig. 1042 Cast Steel Globe	ThermostaticValveBypass
R	2	Fig. 280-UN Bronze Gate	Condensate Line Shutoff
S	1	Fig. 962 Bronze Swing Check	Prevent Condensate Backflow
T	2	Fig. 976-A Bronze Globe	Trap Test, Free Blow
U	1	Fig. 352 Bronze Swing Check	Prevent Backflow
V	2	Fig. 47-U Bronze Gate	Cold Water Shutoff
W	4	Fig. 703 Bronze Globe	Flow Meter Pressure Taps
X	4	Fig. 976-A Bronze Globe	Drain Lines
Y	5	Fig. 703 Bronze Globe	Pressure Gage Control
Z	2	Fig. 976-A Bronze Globe	Air Vents
AA	4	Fig. 923 188M Globe	3 Way Valve Bypass
BB	4	Fig. 976-A Bronze Globe	3 Way Valve Bypass
CC	5	Fig. 280 Bronze Gate	3 Way Valve Shutoff

How to plan a HIGH PRESSURE-HIGH TEMPERATURE HOT WATER PIPING SYSTEM

For efficient space and water heating — and for numerous processing needs as well — a high pressure-high temperature system offers several distinct advantages over a steam system.

Often operated at pressures up to 215 psi, with a corresponding temperature of 388°F, a HP-HT system of this type eliminates the need for pitch, drainage, or traps and provides a greater amount of heat transmission for a given pipe size. Moreover, it requires no feed-water treatment and, when used for processing services, eliminates large pressure drops due to sudden load conditions.

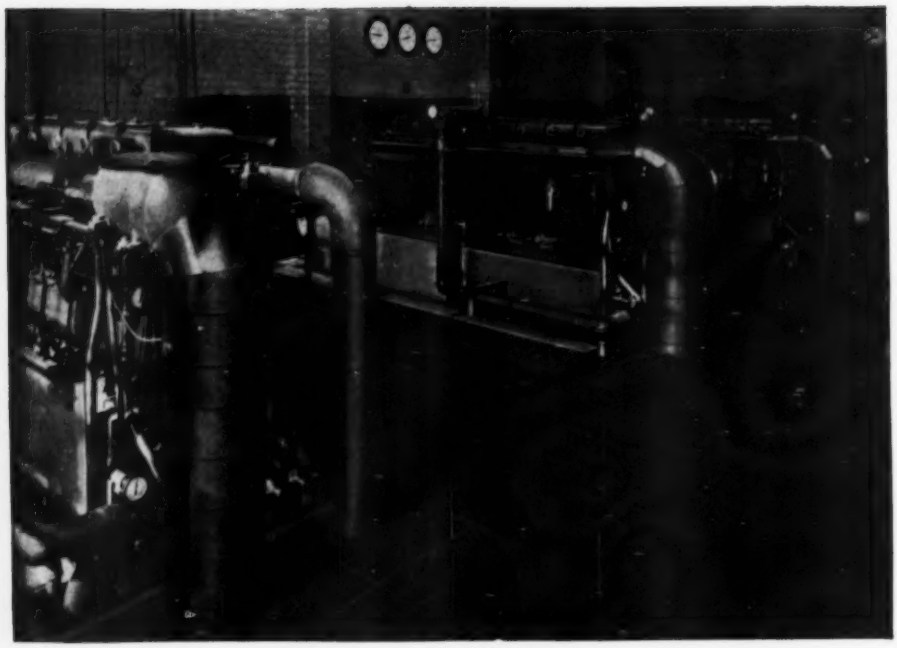
The hot water is generated in a shell and tube heat exchanger by means of high pressure steam from either turbine extraction or exhaust. Unit heaters on the HP-HT lines provide for space heating requirements and a shell and tube heat exchanger supplies warm water for lavatories, kitchens, and processing which requires moderate temperatures. When used with accumulators, this system eliminates the need for taking additional steam directly from the steam generating source and, thus, provides a better plant heat balance.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

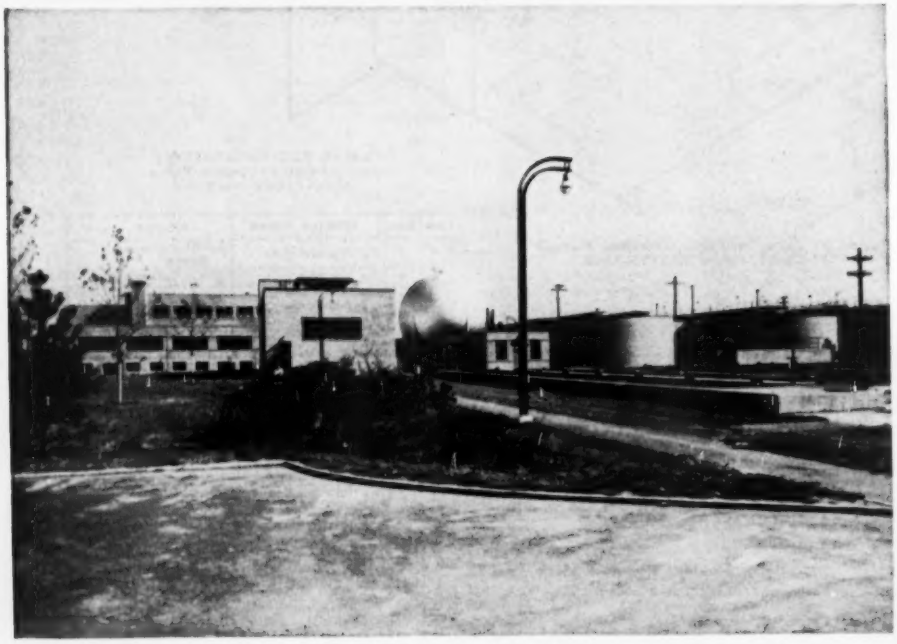
To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 68.

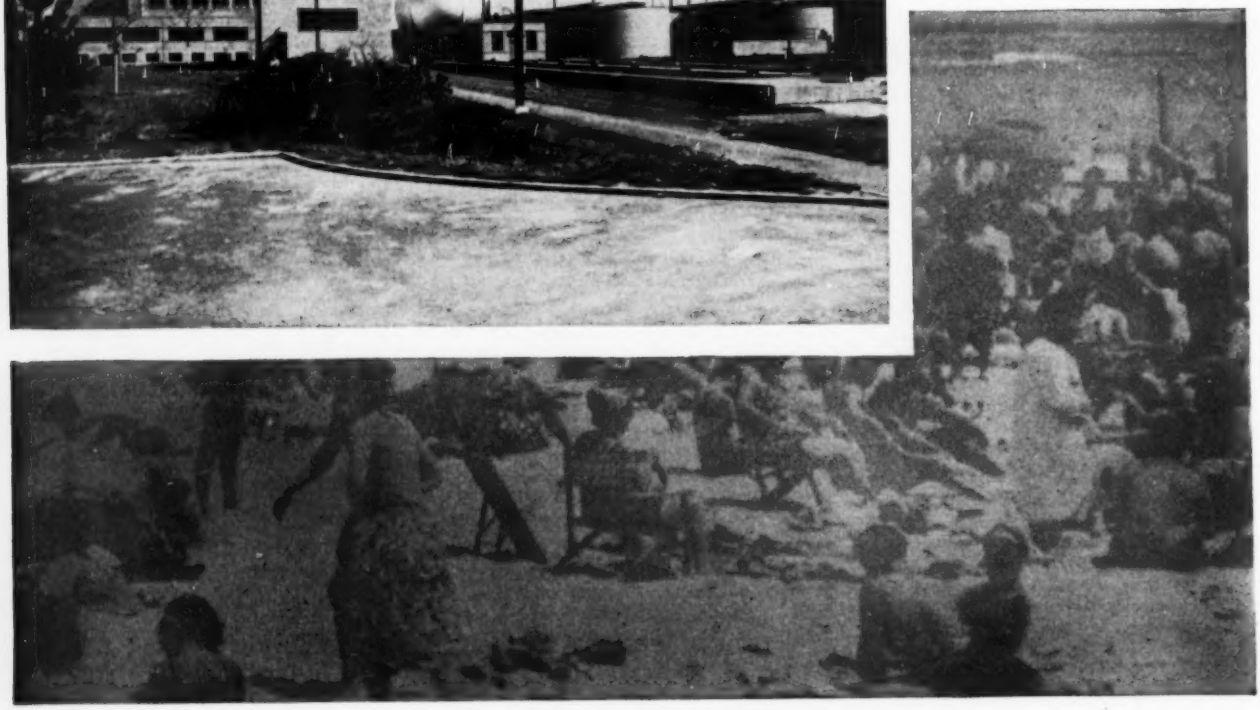
JENKINS VALVES
LOOK FOR THE DIAMOND MARK
Jenkins Bros.



Three 306 BHP, 600 RPM, Chicago Pneumatic Dual Fuel Engines generating power for Rockaway Sewage Treatment Works.



The New York City Rockaway Sewage Treatment Works.



"Behind-the-Scenes" LIFEGUARD to 12,000 acres of playland

Not many people realize what the Rockaway Pollution Control Project means in the future development of Jamaica Bay as a 12,000 acre swimming, boating and park area. An important role in cleaning up the waters of Jamaica Bay is played by the CP Dual Fuel Engines that generate power for the Rockaway Sewage Treatment Works. These "behind-the-scenes" lifeguards are just one of the many units manufactured by Chicago Pneumatic that afford tops in power performance, low operating cost and rugged dependability. CP diesel, dual fuel and gas engines are available in sizes capable of delivering from 120 hp. to 1750 hp. If your community is faced with purification problems of lake, river, bay or harbor, let Chicago Pneumatic do the same dependable job for you they are doing in this outstanding plant at Rockaway.

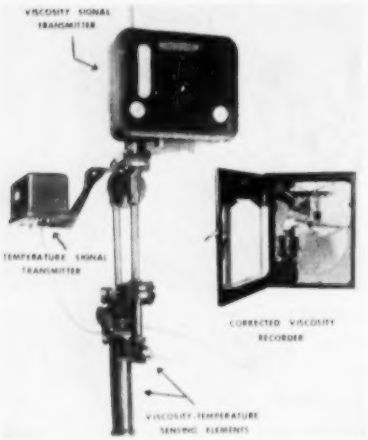
Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.

Chicago Pneumatic
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS

new equipment

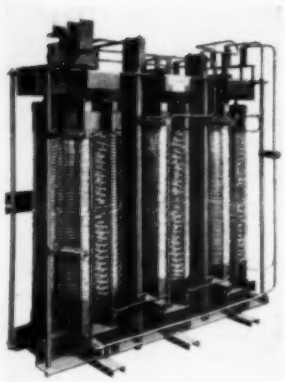
(Continued from page 8)

variations in line voltage or frequency and works from momentary or sustained contact without an auxiliary relay. The unit requires 8 w and operates on 105 to 125 v, 50 or 60 c supply. Time intervals range from 1/10 to 60 sec.



Unit records and controls viscosities

J16 A temperature-compensated, continuous viscosimeter designed for recording and controlling viscosity at a selected reference temperature has been developed by Fisher & Porter Co. Called the Viscorator, it can record continuously without heat exchangers, constant temperature baths, or other special accessories and can operate routinely at stream temperatures up to 700 F and at various viscosities from 34 SSU to more than 10,000 SSF. Both the specific viscosity index and its base reference temperature may easily be reset in the field. It can be fitted to record one or several variables, such as viscosity of the measured stream, viscosity corrected to a selected reference temperature, and temperature of the stream. Additional information is given in a catalog.

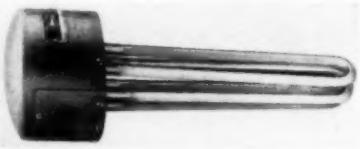


Transformer used for high voltage sub-stations

J18 Extra protection needed during peak operating periods is claimed for the 1000 kva, 4160-480 v, delta-delta, dry type transformer designed for Hevi Duty Electric Co. Adequate core and coil blocking, high voltage insulators, and well ventilated pancake type coils are safety features. Transformers are available in sizes up to 2000 kva and 15,000 v, either as a core and coil unit or in steel enclosures. A bulletin provides information on these and other models.

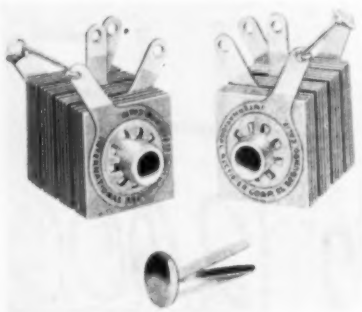
TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 123. Your requests will be handled promptly.



Electric immersion heater provides higher heat output

J19 Higher heat output and a new size flange, 5⅜ in. dia, are featured by the Chromalox flanged tubular-type electric immersion heater, manufactured by Edwin L. Wiegand Co. Type TM-4, for water heating, has copper sheathed elements brazed to a brass flange. For oil or paraffin, type TMO-4 has steel sheathed elements welded to a cast iron flange. Both types are single phase only and available in 120, 240, 480, and 550 v ratings with capacities from 4 to 12 kw.



Rectifier improves operation of magnetic devices

J20 For the operation of magnetic devices such as relays, solenoids, and electric counters, International Rectifier Corp. has developed the type D-3575 single phase selenium, bridge rectifier. The unit is designed for use directly from 117 v, a-c systems with an output of 9 w at 90 v, d-c continuous duty. By using a 3 mfd or larger filter capacitor, it will deliver 117 v, direct current to permit direct operation of magnetic devices from 117 v, a-c lines. In addition, burning of delicate contacts is eliminated and iron core losses are reduced.

Multiplexing equipment transmits over single circuit

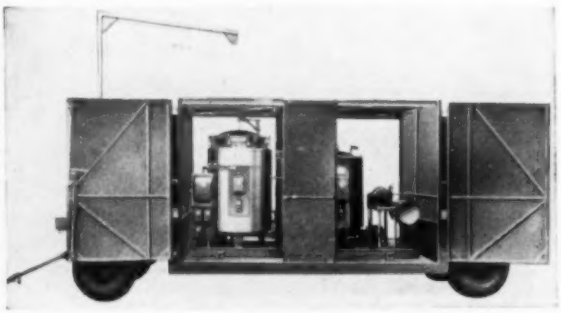
J21 Bristol Co. has developed a multiplexing transmitting and receiving system for use with its Metameter Telemeters. Up to 15 readings, such as pressure, vacuum, water or liquid level, and flow, taken at separate locations or areas, can be sent any distance to receiving instruments over a single circuit. Readings can be transmitted over telephone circuits, carrier current, microwave, VHF, and

(Continued on page 16)

Transformer oil reconditioned on site

J17 Dirty insulating oil can now be restored to its original condition without removing the transformer or withdrawing it from service. U. S. Hoffman Machinery Corp. has developed a complete, portable, oil reconditioning plant that is designed to move along rights-of-way through forests, cities, and mountains. Use of the portable unit eliminates the need of transporting tons of dirty oil to a central filtration plant.

The main section of the Filtermobile consists of a large van with doors to keep out dust and weather when in transit. Platforms at both ends may be used for carrying filtering supplies and transformers. One or more transformers are usually required to reduce line voltage of current used by the filtration equipment. A hoist is provided for handling equipment and for lifting filter cartridges.



Sound Selling vs. Smart Talk

Today, essentially, all of the chemical companies have established technical service and sales-supporting technical work. One corporation has 25 laboratories devoted to this type of work supported by 29 field laboratories. The total investment by the industry in such facilities, must run well into the tens of millions of dollars, which is one measure of how importantly the industry regards the sales function.

It is now estimated that 70% of the average chemical company's sales staff is technically trained compared with probably less than 25% only 20 years ago and an insignificant percentage 30 years ago. This current mode of selling is epitomized in the slogan of one chemical manufacturer, namely, "Serving Industry through Practical Applied Science."

From an article: "Selling . . . Its Importance in the Chemical Industry," by J. Warren Kinsman, Vice-President, E. I. du Pont de Nemours & Co., Wilmington, Del., in Chemical Engineering Progress.

Nalco appreciates the use of its slogan, "Serving Industry through Practical Applied Science", as an example of the modern approach to chemical sales. 100% of Nalco's field service representatives are technically trained to help industry make full practical use of the chemicals and methods developed by the Nalco Laboratories: Water, Microbiological, Physical Chemistry, Organic Chemistry, Corrosion, Micrography, Metallographic, Experimental Boiler, Combustion, Oil Treatment, Paper, Ion Exchange, Weed Control, Production Control.

NATIONAL ALUMINATE CORPORATION
6218 West 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario

THE *Nalco*® SYSTEM . . . Serving Industry through Practical Applied Science

"WE MODERNIZED OUR PLANT, INSTALLED

This view shows how River Raisin has installed its modern fly-ash re-injection system at the rear of the boilers but outside the plant. The plant also features outdoor coal handling to save additional interior space. Coal is delivered to the stoker hoppers through automatic scales which weigh and record the flow.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

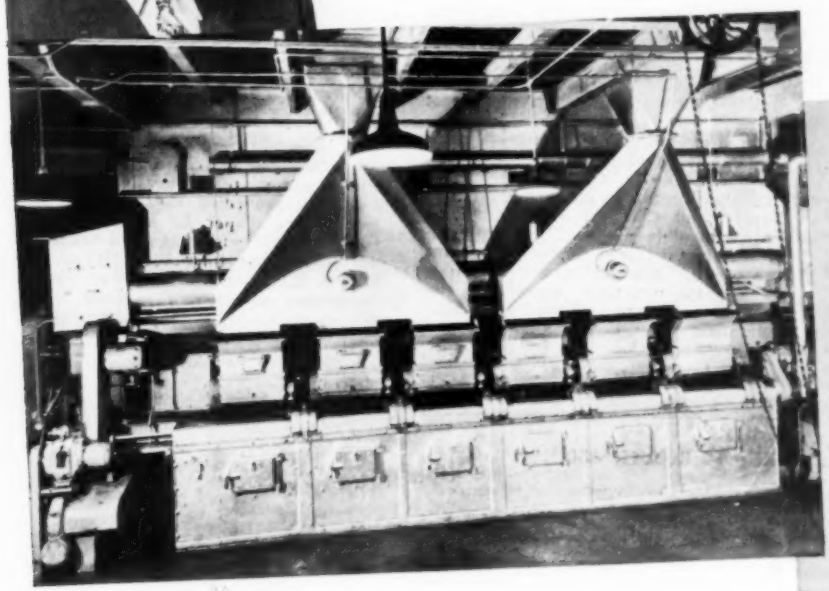
COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY—FOR LOW COST

NEW COAL-BURNING EQUIPMENT, AND CUT OUR FUEL COSTS 45%!"

says Mr. A. J. Goetz, Executive Vice President, River Raisin Paper Co., Monroe, Michigan.

"We recently modernized our entire plant following an extensive engineering survey. New coal-burning equipment was installed...our coal-handling system was redesigned...heat losses were reduced...efficiency raised. As a result, our fuel costs have been cut 45 to 50%—proving to us that for economy and efficiency you just can't beat bituminous coal burned the modern way."



"These modern spreader stokers fully meet the special requirements of our operation. They feature low power requirements, low maintenance, and have the ability to meet fairly rapid load changes. They give us maximum efficiency under all operating conditions."

Modernizing your present plant? Building a new one? In either case it will pay you to get the *modern* facts about coal from a consulting engineer. He'll show you how an up-to-date coal installation can meet your *specific* needs—and at the same time save you more money than you thought possible.

With automatic coal- and ash-handling equipment you can cut labor costs to a minimum . . . and a modern combustion installation will give you more steam for less fuel. Actually, today, you can get from 10 to 40% more power from each ton of coal than was possible a few years ago.

And, if you burn coal, you'll never have to worry about a shortage of fuel. America's coal reserves are virtually inexhaustible, and this coal is mined by one of America's most efficient and productive industries.

This means that coal users—unlike those committed to other fuels—get the advantage of dependable future supply as well as the most stable prices.

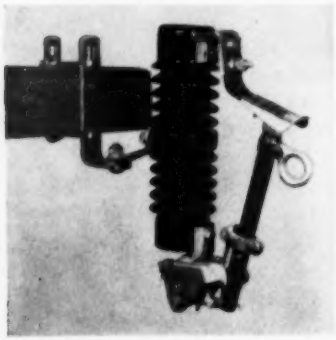
BITUMINOUS COAL INSTITUTE
A DEPARTMENT OF NATIONAL COAL ASSOCIATION
WASHINGTON, D. C.

YOU CAN COUNT ON COAL!

new equipment

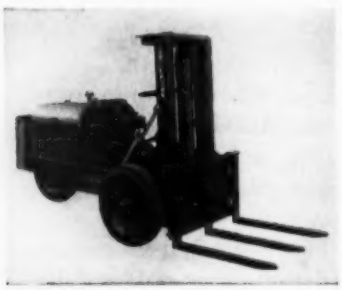
(Continued from page 12)

UHF, private wires, and rental telemeter circuits available from the telephone company.



Load break device gives better fault protection

J22 General Electric's Distribution Transformer Dept. reports better fault protection or opening of circuits under load by an improved line of open-dropout fuse and load-break cutouts. The breaking device provides a low-cost means of sectionalizing main feeders, switching transformers, capacitor banks, and other loads. Ratings are 7.8 and 15 kv., 100 amp. Three interchangeable fuse holders provide NEMA standard 2000 amp interrupting rating, heavy-duty 5000 amp interrupting ratings, and load-break up to 100 amp, any power factor.



Lift trucks assure traction on soft ground

J23 For jobs requiring small, compact power lift trucks, both indoor and outdoor, Erickson Power Lift Truck, Inc. has developed models F-4R and F-6R with 4000 and 6000 lb fork lift capacities. Large pneumatic tires on all wheels, and 12 in. center underclearance, assure excellent traction on rough or soft ground, and easy clearance of obstructions. A short wheelbase and turning radius permits maneuverability in close quarters and a ballast box at the back of the unit provides for varying balance weight for each individual job. A 24 bhp engine with a heavy duty clutch and dual transmission provides 4 speeds forward and 4 speeds reverse, up to 25 mph.

Turbine pump motor horsepower ratings increased

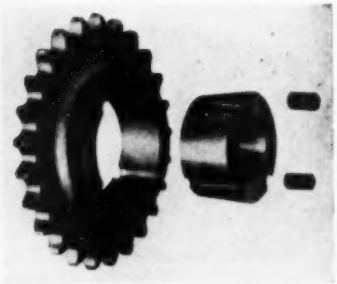
J24 U. S. Electrical Motors, Inc., has announced that ratings of totally-enclosed and explosion-proof vertical pump motors have been increased to 75 hp. Explosion-proof models are designed to comply with UL specifications for Class I—Group D highly inflammable gases and volatile liquids, and Class II—Groups F and G combustible dusts. The totally-enclosed motors are ideally suited for protection against non-combustible dust, dirt, moisture, abrasives, and corrosive drippings. Units are available with either hollow shaft or solid shaft construction.

TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 123. Your requests will be handled promptly.

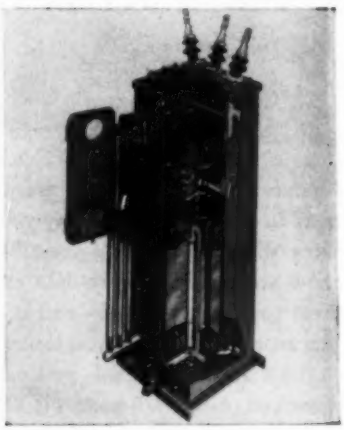
Portable electric instruments take rough usage

J25 Maximum convenience and readability are design features of improved portable electric instruments manufactured by the Meter and Instrument Dept. of General Electric Co. For general maintenance testing, type DP-11 is rugged and easily read with an accuracy of 0.5 percent of full scale. Type DP-12, accurate to 0.25 percent of full scale, is particularly suited for testing portable or switchboard instruments, control panels, and numerous production devices. Dependability in all ratings, including microammeters, is provided by high flux density of two alnico magnets. Models are available to indicate volts, watts, amps, and milliamps.



Bushed sprocket facilitates delivery

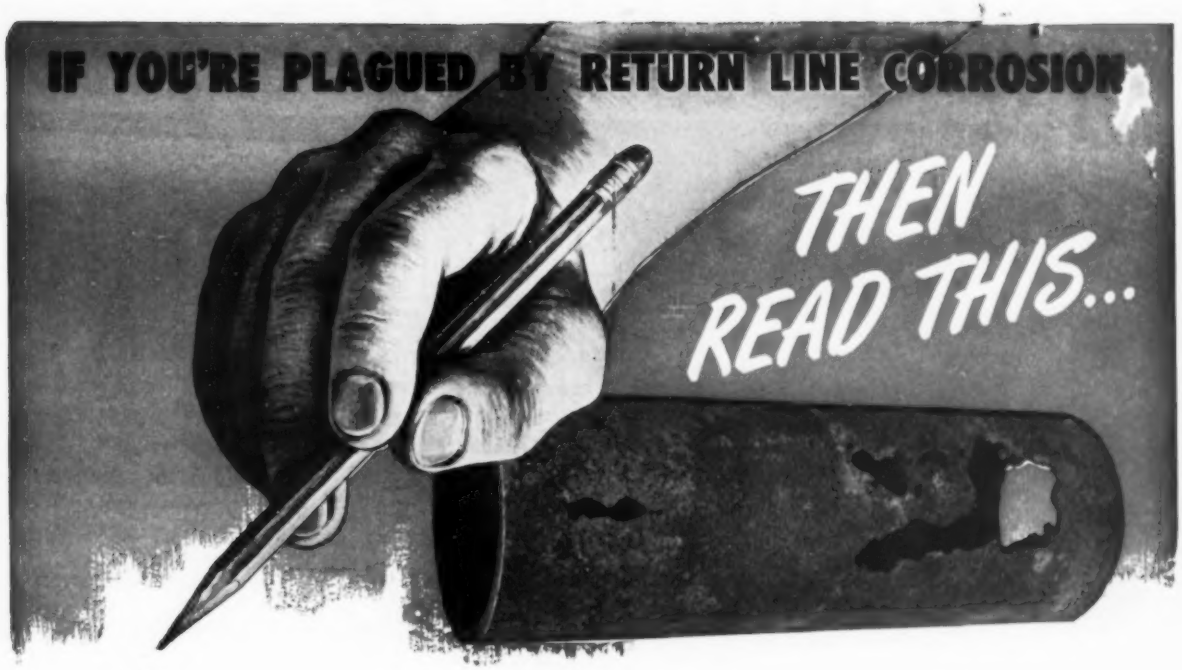
J26 Split tapered bushings used with roller chain sprockets facilitate immediate delivery and rapid installation, according to Link-Belt Co. Use of the Taper Lock bushing assures tight fit within the full range of normal shafting tolerances without reboring. Easy removal is accomplished by turning set screw in removal holes. Sprockets for ½, ⅝, ¾, 1, and 1¼ in. pitch, single-width chains are available. Specifications are tabulated in a 16-page bulletin.



Induction voltage regulator simplifies maintenance

J27 Improvements in the type SU induction voltage regulator manufactured by Westinghouse Electric Corp. have resulted in a lighter and dimensionally smaller unit that is simpler to maintain. A type SJ voltage regulating relay is used to eliminate all mechanical adjustments. This relay has no pivot or guide bearings to

(Continued on page 22)



As an engineer responsible for efficient, economical plant operation, you know only too well that corrosion of steam and condensate lines can send costs skyrocketing through pipe replacement, interrupted production, and increased labor and maintenance. Perhaps you, like many other engineers, have tried stop-gap methods to check the problem only to find them partially effective or far too costly.

Realizing the importance of this major industrial problem, Betz Laboratories has developed its patented filming amine treatment. Here, at last, is a simple, inexpensive, and practically 100% effective method of eliminating this costly and production-disrupting headache.

For example, a linoleum company, operating at 150 psi and producing 300,000 pounds of steam per day, employed sodium zeolite softening for a high bicarbonate raw water. The carbon dioxide content of the steam averaged 40 ppm. Continued maintenance was required due to failure of condensate lines from the steam kettles and unit heaters. After the filming amine treatment was applied, maintenance records showed an annual saving of approximately $8,000.00! And, a large part of this saving was obtained by eliminating weekend over-time work on pipe replacements.

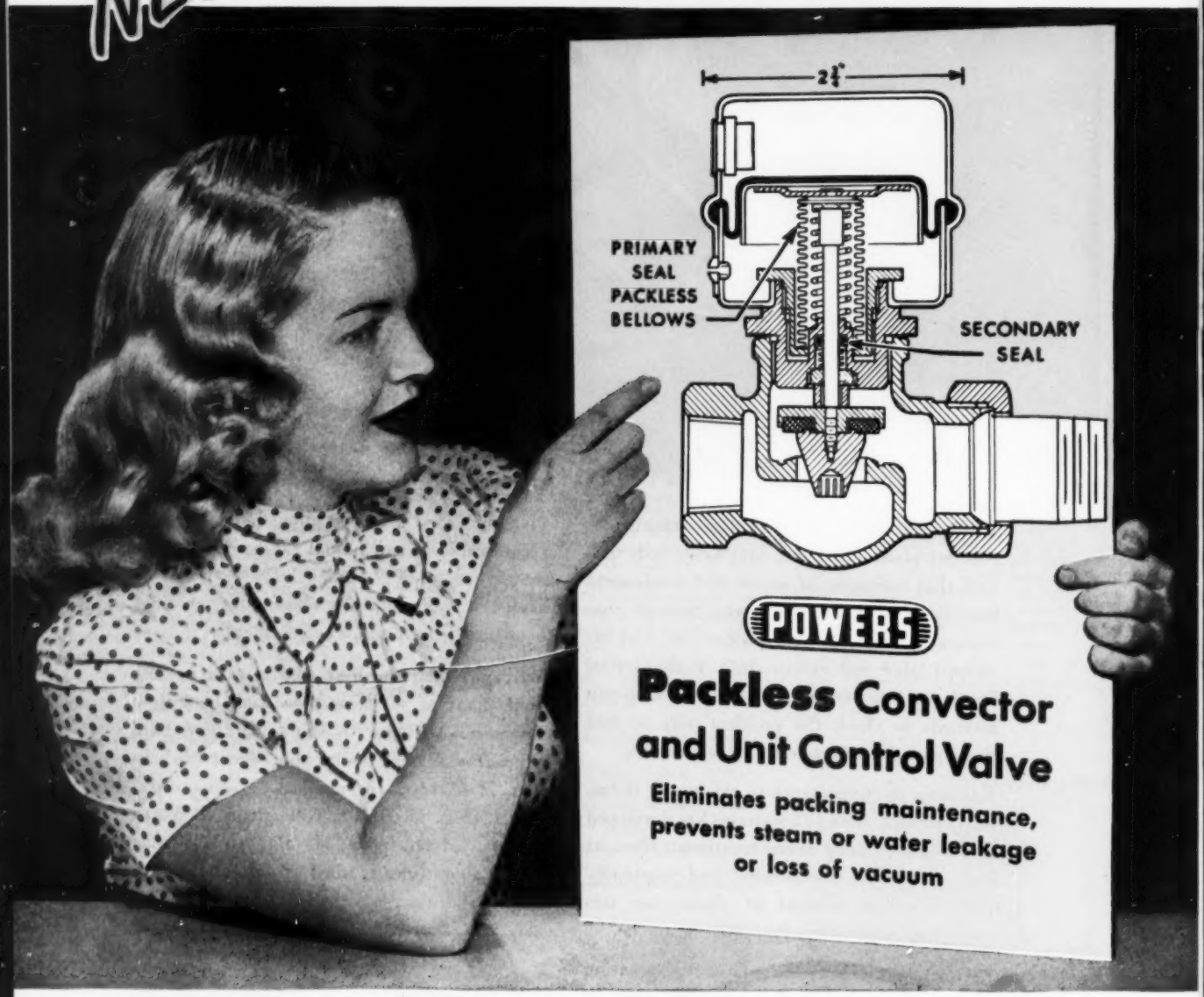
Why not take the first step toward ridding your plant of corrosion *now*? Call in a Betz Engineer. Ask him to show you how Betz *Specialized* Water Conditioning Service can help you . . . quickly . . . economically . . . effectively. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

See for yourself how Betz filming amine treatment eliminates return line corrosion and reduces operating costs. Send for Technical Bulletin No. 124.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

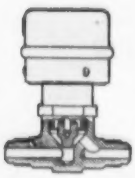
NEW! POWERS PNEUMATIC *Systems of*

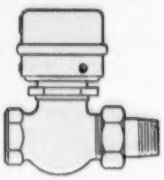

2¾"
PRIMARY SEAL PACKLESS BELLOWS
SECONDARY SEAL
POWERS
Packless Convector and Unit Control Valve
Eliminates packing maintenance, prevents steam or water leakage or loss of vacuum

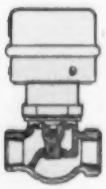
POWERS-**PACKLESS**-VALVES

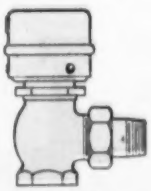
Never require re-packing.

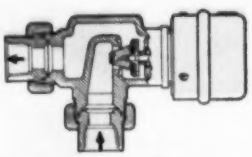
Real Economy in Maintenance year after year


Flared Ends

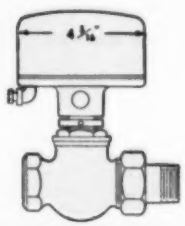

Straightway Union


← Screwed Ends

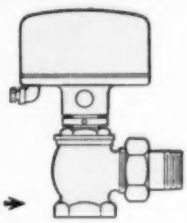

Angle Union

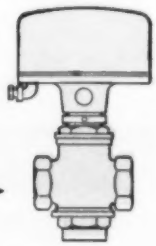

Reverse Flow Double Union

Available in various types and sizes for control of convectors, unit ventilators, unit air conditioners and radiators.



Straightway Union


Angle Union →


3-Way Screwed Ends →

Automatic Temperature Control
Now Include

POWERS-PACKLESS-VALVES

For Controlling Convectors, Unit Ventilators, Unit Air Conditioners and Radiators.

Now, at NO Extra Cost — users of Powers pneumatic control systems will get the additional benefits of still lower operating and maintenance costs — insured by Powers packless valves.

Duo-seal Construction Gives Them Superior Performance. Bronze packless bellows is the Primary Seal which eliminates packing maintenance — packing friction — steam and water leakage or loss of vacuum. Secondary Seal permits servicing of valve top without draining the water system or shutting off the steam supply.

Typical Specifications for POWERS-Packless-Pneumatic Control Valves

Control valves for convectors, radiators and unit ventilators shall be packless type with bronze packless bellows to eliminate steam and water leakage or loss of vacuum. This packless bellows shall be located so that it is not subject to corrosive action of the steam or water. A spring-loaded secondary seal shall be provided to permit convenient inspection or servicing of valve top without draining the water system or shutting down the steam supply.

Valve sizes shall be determined by control manufacturer for capacities specified. Type of valve body and valve top to be used shall be as required to best satisfy the application.

Valves shall be equipped with phosphor bronze bellows or Neoprene diaphragms of sufficient size to close off against specified line pressures. Diaphragms shall be replaceable. Valves shall be equipped with characterized throttling plugs to insure a measured flow of steam or water in direct relationship to the demand of the controlling thermostat.

POWERS CONTROL

THE POWERS REGULATOR CO.

Skokie, Ill. • Offices in Over 50 Cities in the U. S. A., Canada and Mexico
See Your Phone Book

OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL

Banish PACKING Maintenance

No Loss of Vacuum

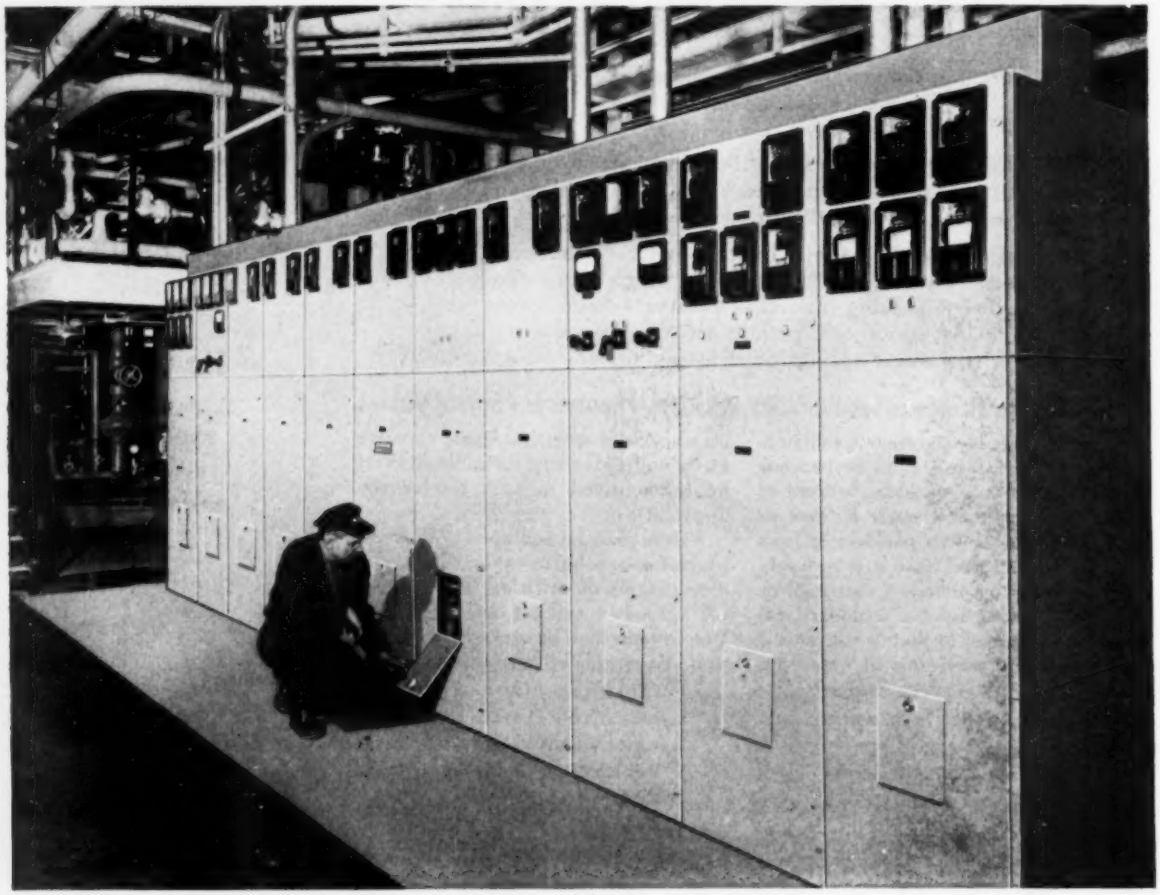
...leakage of air reduces efficiency of heating system and increases corrosion in return lines

No Steam or Water Leakage

(b18)

Only a Few of POWERS Complete Line of Modern Control Valves
for Regulating Heating and Air Conditioning Systems
FLOWRITE VALVES
METAFLOW VALVE
PACKLESS VALVES
METAFLOW VALVE
FLOWRITE VALVES

Specify I-T-E switchgear....



Typical installation of Metal-Clad Switchgear. Shown here at the Tucson Gas & Electric Light & Power Co.

Total cost is the important figure, when comparing makes and types of switchgear. What will the overall cost be, after the switchgear is *installed* and *operating?* Engineering and planning time—as well as installation, maintenance, and operating costs—must all be included in this total.

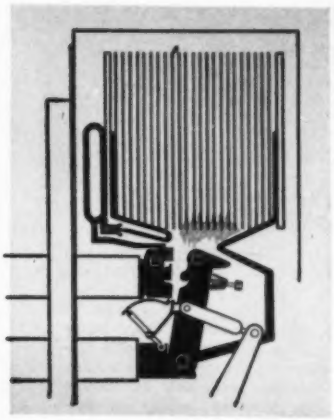
The purchase of I-T-E Metal-Clad Switchgear provides a long series of tangible savings—savings felt during every stage of electrical expansion and new construction.

PLANNING ASSISTANCE

An I-T-E Application Engineer has the experience to help you select coordinated equipment for your specific application problem. This releases your own technical and purchasing staffs for broader planning duties.

for over-all economy

Consider these important benefits from I-T-E Metal-Clad Switchgear:



1

Proved performance and reliability

Superiority of the I-T-E method of arc interruption—*in air*—is thoroughly proved by the thousands of efficient I-T-E power circuit breakers now in service.

2

Quick delivery

Through the years, I-T-E has maintained an enviable record in fulfilling delivery promises. Prompt shipment of switchgear helps to keep construction on time or even ahead of schedule.

3

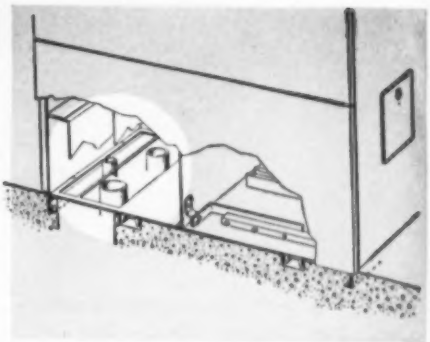
Simplified testing

I-T-E's unique "fast-test" feature permits secondary circuit testing without opening the circuit breaker compartment door. Racking the horizontal drawout breaker to test position gives safe immediate access to the operating station. Breaker is available for testing in a matter of seconds.

4

Simplified installation

I-T-E switchgear is assembled, tested, and shipped as a complete unit. Floor plan drawings are sent in advance to permit immediate installation of channel base and positioning of conduit or cable. All that remains is to position the switchgear and make necessary connections.



5

Long, trouble-free life

I-T-E selection of premium materials and components pays dividends in long equipment life. Every detail of I-T-E Multumite construction points to continuous, trouble-free service even under the most severe operating conditions.

For details call the I-T-E field office nearest you. Look in the classified section of your telephone directory under "Electrical Equipment". Or write for *Catalog Sec. 7000.* I-T-E Circuit Breaker Co., *19th and Hamilton Sts., Philadelphia 30, Pa.*

I-T-E

METAL-CLAD SWITCHGEAR

new equipment

(Continued from page 18)

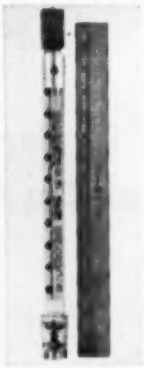
require frequent maintenance, and has operated 100 million times on test with no recalibration required.

Parts washed automatically

J28 Quick, automatic cleaning of small parts, complete assemblies, and tools is made possible by the air-powered washer now being produced by Kelite Products, Inc. The oscillating turntable, submerged in cleaning fluid, will take loads up to 100 lb. Speed may be varied from 0 to 240 opm by a dial on the ¼-hp air motor which operates at air pressures of 30 to 120 psi.

Grease lubricates over extended temperature range

J29 Satisfactory performance in ambient temperatures ranging from minus 100 to plus 250 F is possible with Low-Temp 1888 grease developed by The Texas Co. It is formulated to permit operation beyond 250 F for short periods. Developed originally to accommodate the extreme conditions encountered in stratospheric flight, it is used to lubricate anti-friction bearings, gears, rolling and sliding equipment having very low motivating power, some types of electronic equipment, instruments, and small actuators where starts at temperatures as low as minus 100 F may be required.



Tank gage samples bottom content

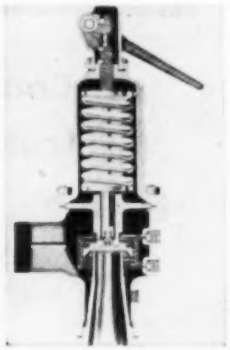
J31 An exact sample of the bottom content of liquid storage tanks is said to be obtainable with a gage developed by Visa-Test Sales Co. Permanently fastened to the end of the standard tank measuring stick, it shows a cross-section measurement of the water, sludge, and other foreign matter which may be drawn by the suction line.

TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 123. Your requests will be handled promptly.

Coating protects condenser tubes

J32 To apply a protective coating against costly inlet end erosion of condenser tubes, which frequently causes failure within the first few inches of tube length, Thomas C. Wilson, Inc. is manufacturing an inexpensive cleaning and application kit. By using the kit, the job can be easily accomplished in three simple steps using any labor available. The method prolongs tube life by insuring removal of deposits, providing excellent protective adherence, and making certain that a protective coating is spread evenly on the tube. The kit is described in a bulletin.



Heat exchanger for safety relief valves

J33 Farris Engineering Corp. has developed an internal heat exchanger for use on all Farris nozzle and semi-nozzle safety relief valves. It can be incorporated in the valve body without creating interference with the valve's mechanism. It eliminates steam tracing or steam jacketing of valves where highly viscous lading is encountered, and is said to keep lading material in a fluid state with exceptionally low steam consumption. A trap drains the coils.

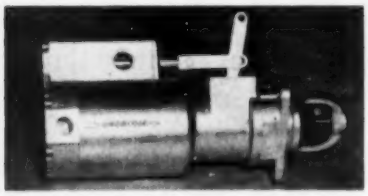
Wire pulling eased by aluminum enamel coating

J34 Aluminum enamel interior coating applied to National Electric Products Corporation's Xduct rigid steel threaded conduit is said to ease wire pulling up to 66 percent. In addition, a special process used to apply a zinc coating to the outside surfaces of the conduit assures resistance to both corrosion and flaking during bending operations. A brightening agent adds to the corrosion resistance and protects the threads which are machined before galvanizing. The conduit is available in 10 ft lengths from ½ to 6 in. dia.

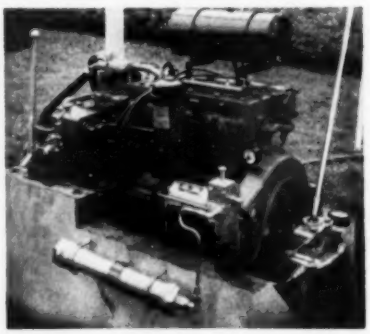
(Continued on page 27)

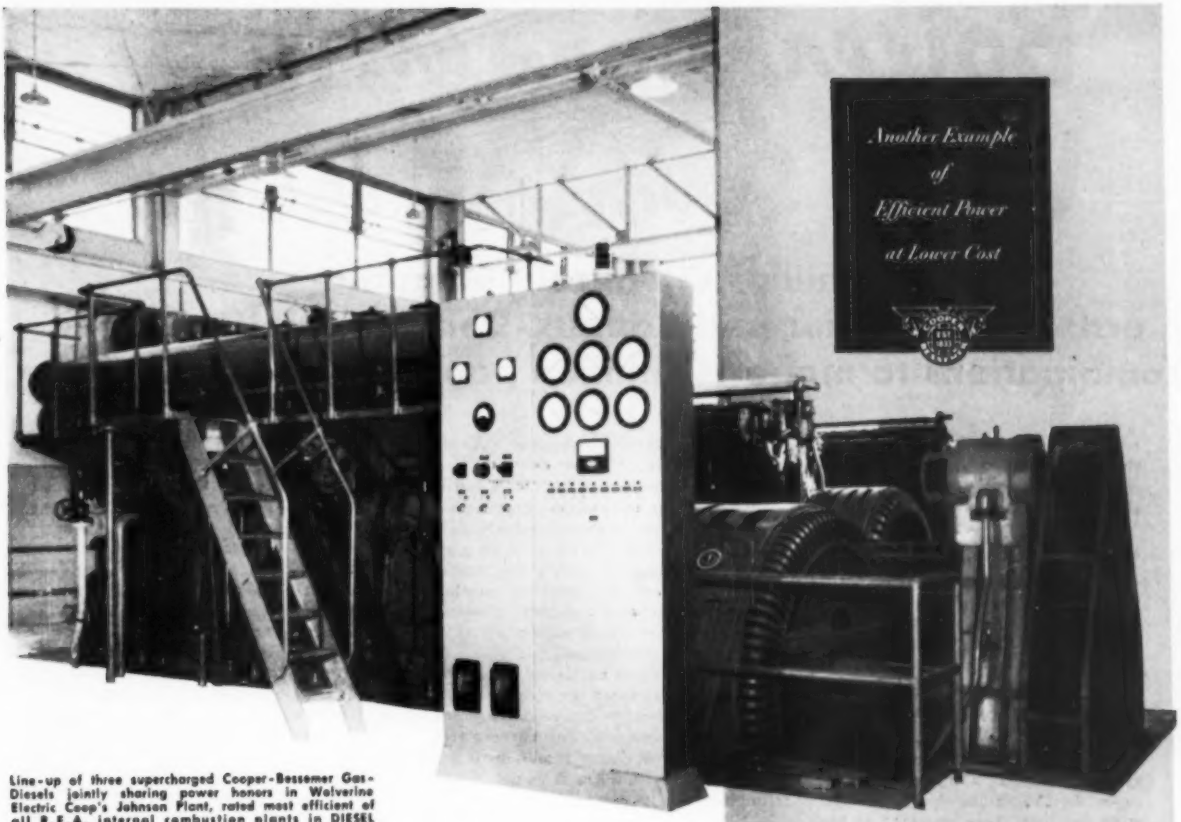
Hydraulic cranking motor assures positive starting

J30 Storage batteries and electric or pneumatic starters for heavy duty engines are eliminated by a hydraulic cranking motor developed by Hydramotive, Inc. Known as Hydrotor, the unit provides efficient, independent cranking over a wide range of temperatures. Higher cranking speeds with less bulk weight are said to result from higher torque characteristics.



For frequent starting, an engine driven pump and unloading valve can be furnished to recharge the accumulator during engine operation. Principle advantage of the system, however, is that energy can be readily restored to the accumulator by a hand pump, whereas a discharged battery or depleted air receiver may result in complete failure of motive power. Literature is available.





Line-up of three supercharged Cooper-Bessemer Gas-Diesels jointly sharing power honors in Wolverine Electric Coop's Johnson Plant, rated most efficient of all R.E.A. internal combustion plants in DIESEL PROGRESS annual award.

IT'S COOPER-BESSEMER, 4 OUT OF 5

in the nation's most efficient R.E.A. *plants!*

● Listed opposite, in the order of their standing, are the five R.E.A. plants cited for the highest operating efficiency during 1952.

Needless to say, it is a matter of pride and satisfaction to us that Cooper-Bessemer engines have contributed to the championship performance of the four highest rated plants. This year, credit for powering the top award plant is jointly shared by Cooper-Bessemer. Of the remaining four plants the three next in order are exclusively Cooper-Bessemer powered.

This is the second annual award . . . and the second time Cooper-Bessemer engines have come in for *top* honors. It's mighty strong evidence that you just can't beat Cooper-Bessemers for holding efficiency up and costs down!

★ **WOLVERINE ELECTRIC COOP.**
Johnson Plant, Hersey, Michigan
Net KWH 27,932,458
Adjusted net power cost . . . 6.85 mills per KWH

★ **M & A ELECTRIC POWER COOP.**
Green Forest Plant, Poplar Bluff, Mo.
Net KWH 24,708,960
Adjusted net power cost . . . 7.16 mills per KWH

★ **WESTERN MINNESOTA POWER COOP.**
Benson Plant, Benson, Minn.
Net KWH 13,992,000
Adjusted net power cost . . . 7.20 mills per KWH

★ **THUMB ELECTRIC COOP. OF MICH.**
Huron Plant, Cass, Mich.
Net KWH 11,580,700
Adjusted net power cost . . . 7.71 mills per KWH

★ **WESTERN FARMERS ELECTRIC COOP.**
Comanche Plant, Woodward, Okla.
Net KWH 13,408,400
Adjusted net power cost . . . 7.75 mills per KWH

★ **Cooper-Bessemer power**

New York Washington, D.C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Shreveport St. Louis Los Angeles Chicago Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Tulsa Gloucester, Mass. New Orleans, La.

The
Cooper-Bessemer
Corporation
MOUNT VERNON, OHIO — GROVE CITY, PENNA.

Boiler-Burner Team Wins Seven Straight

Phillips Chemical Company orders Vogt boiler and Coppus-Dennis FANMIX burner combinations to make 1¾ million pounds of steam an hour

When a customer praises a product, that's fine. But when a customer *continually re-orders*, that's conclusive proof of user-satisfaction.

Phillips Chemical Company, Borger, Texas — producer of synthetic rubber — first installed Henry Vogt boilers with FANMIX burners back in 1943. As plant production increased, Phillips again purchased the same equipment — in 1946, and again in 1951.

Today, a total of 7 Vogt boilers equipped with Coppus-Dennis FANMIX burners provide 1,750,000 lbs. steam each hour for the production of synthetic rubber. The boilers are designed for 250,000 lbs. steam peak operation but have been operated as high as 275,000 lbs. per hour. Their performance is typical of the efficiency of boilers equipped with Coppus-Dennis FANMIX burners.

FANMIX · Better Combustion · Better Efficiency · Higher Ratings

All Coppus-Dennis FANMIX burners — for gas as well as combination gas-oil — have the exclusive FANMIX action. Their *revolving orifices* give violent mechanical mixing and agitation of gas and air, therefore causing instantaneous and complete combustion with *minimum excess air* (5% excess air is not unusual).

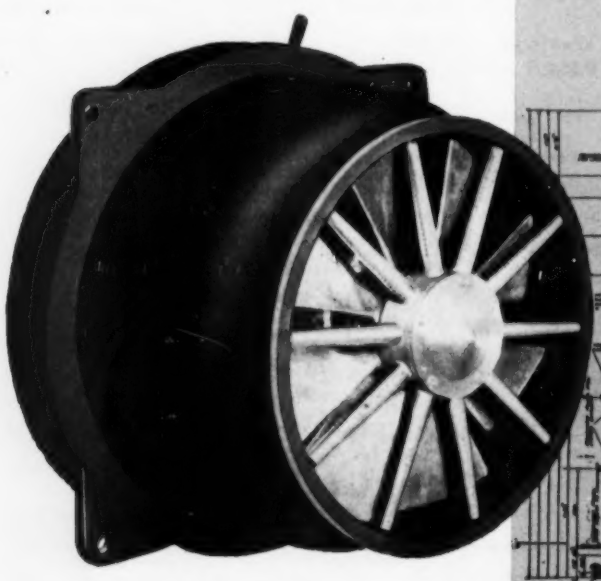
Because of this exclusive FANMIX action, furnace space is not required for mixing and *higher boiler ratings* are thus easily obtained. The burners also have a shorter flame than any other burner and will not cause flame impingement.

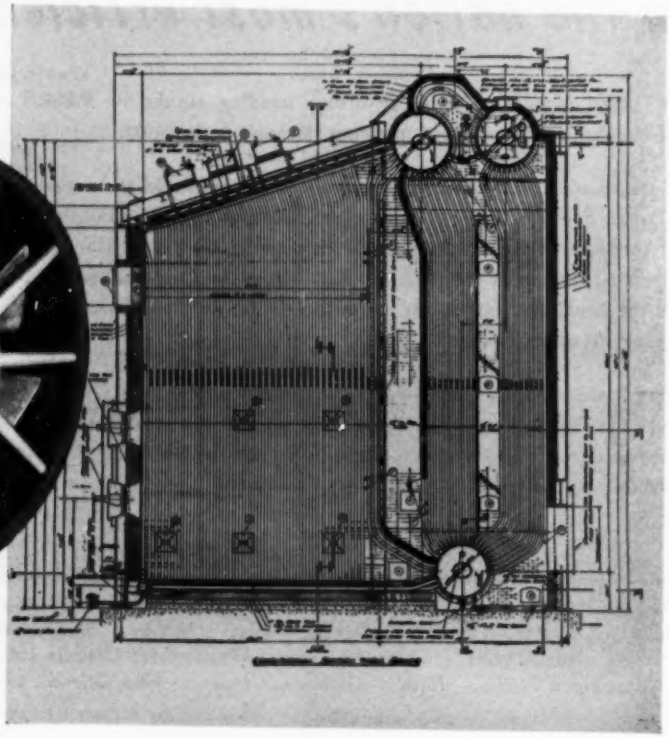
What's more, by incorporating a *fan* as an integral unit, FANMIX burners have *no draft loss* across the burner. As a result, increased ratings are possible regardless of draft conditions.

FANMIX action, with its quick completion of combustion, gives *lower* exit temperatures.

If you are not using Coppus-Dennis FANMIX burners in your present boiler, why not plan now to take advantage of the exclusive FANMIX action? You need no forced draft equipment, increase in stack or increase in furnace volume for FANMIX operation. And you get increased capacity. When specifying FANMIX on *new* boilers, you can plan on reduced combustion space, higher ratings, less stack height or reduced induced draft capacity — and, of course, *no* forced draft equipment.

For further information, mail coupon today. Sales offices in *Thomas' Register*. Other "Blue Ribbon" Products in *Chemical Engineering Catalog, Refinery Catalog, Best's Safety Directory* and *Mining Catalogs*.





JET REACTION is utilized to rotate fan which is integral part of burner. Ideal mixture for fast, complete combustion and peak efficiency is caused by automatically proportioned high velocity air passing at right angles through fuel.

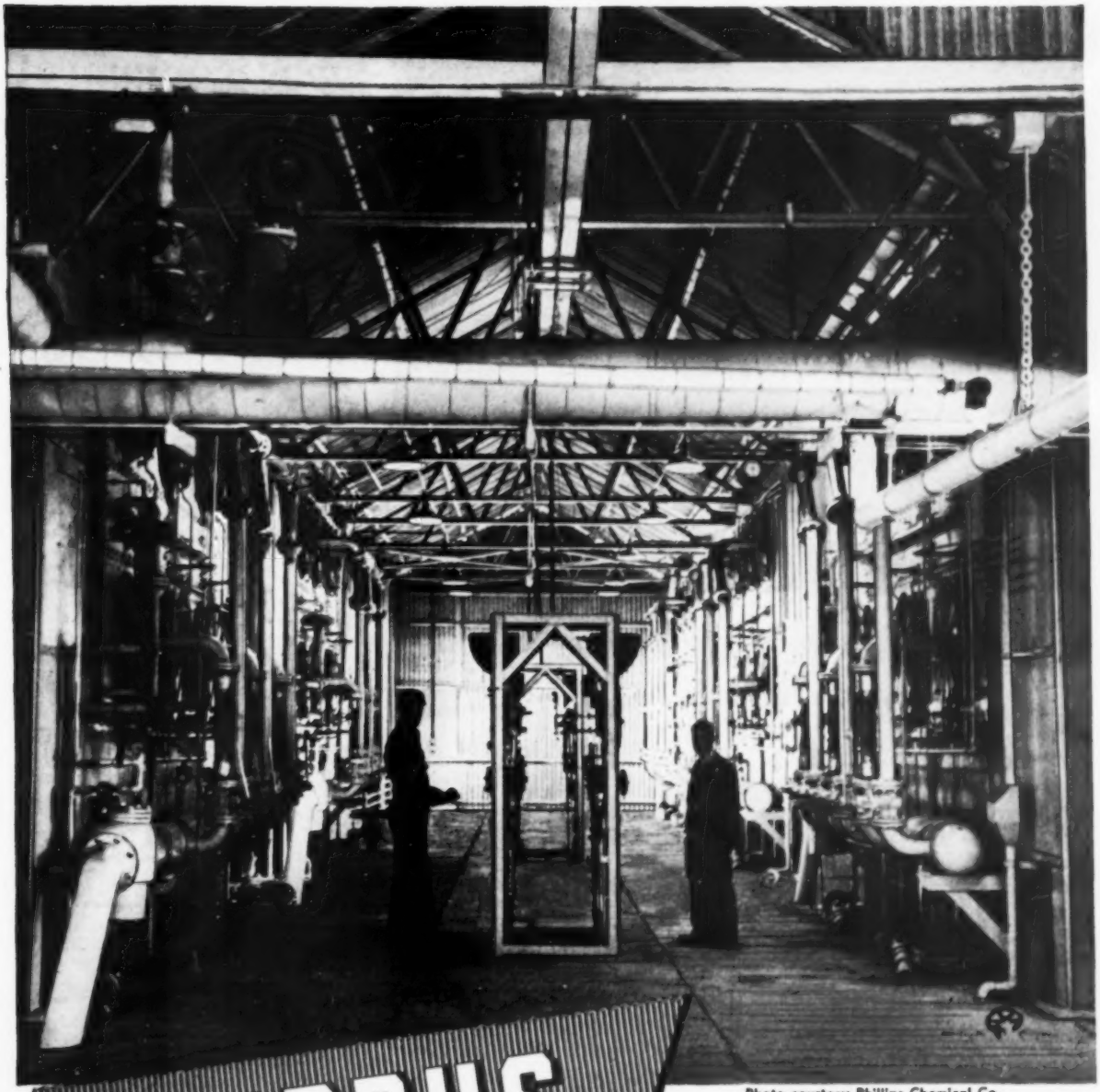


Photo courtesy Phillips Chemical Co.

HENRY VOGT BOILERS are here shown installed in the Phillips Chemical Company, Borger, Texas. Boilers use Coppus-Dennis FANMIX burners.

SEND COUPON for further information. Coppus engineers FANMIX burners to your individual requirements.

PLEASE ATTACH THIS COUPON TO YOUR COMPANY LETTERHEAD

COPPUS ENGINEERING CORPORATION
189 Park Avenue
Worcester 2, Massachusetts

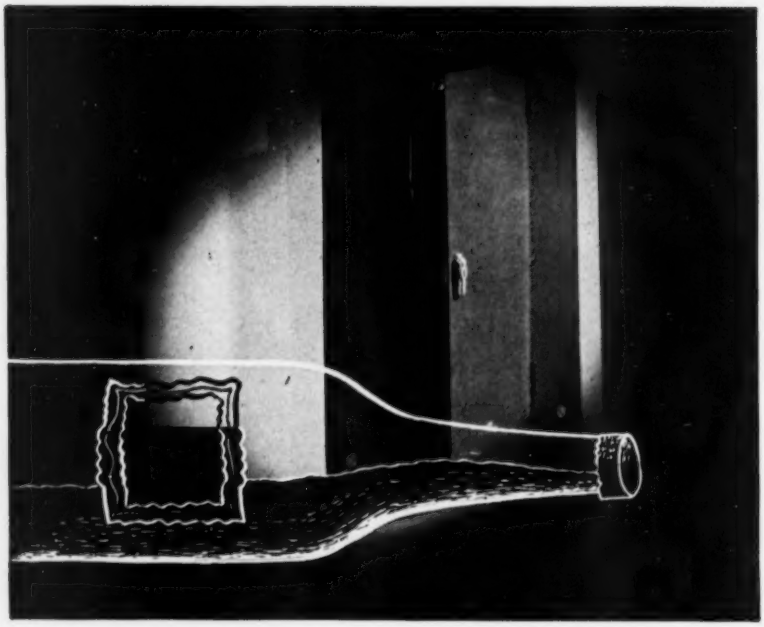
Please send complete data on Coppus-Dennis FANMIX Burners. I'm particularly interested in ☐ gas ☐ combination gas-oil.

Name.....Title.....

Company.....

Address.....

City.....Zone.....State.....



Your panelboard may be your bottleneck

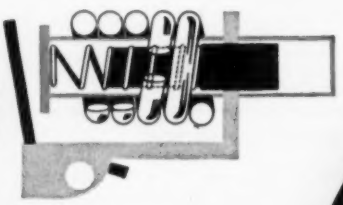
YOUR branch circuits may be wired for 30 or 50 amperes, but do you *really* get that power through your panelboard? Do you have frequent power interruptions during periods of high production . . . particularly in hot weather?

Plant engineers are breaking this nuisance bottleneck by replacing with HEINEMANN Circuit Breakers. The current carrying capacity of HEINEMANN Circuit Breakers does not vary with temperature; nor do the set tripping points. De-rating is never necessary . . . 50 amperes means 50 amperes of usable capacity in your branch circuits. There is never nuisance tripping with the accompanying costly production delays.

HEINEMANN Circuit Breakers operate on a hydraulic-magnetic principle. They provide inverse time delay to allow for starting inrush and harmless, momentary overloads . . . yet they provide the fastest circuit interruption available on large overloads or short circuits.

HEINEMANN Circuit Breakers pay for themselves in another way, too: They have low wattage loss which reduces the current consumption in the panelboard itself . . . a considerable long-term saving.

don't use heat ...USE POWER

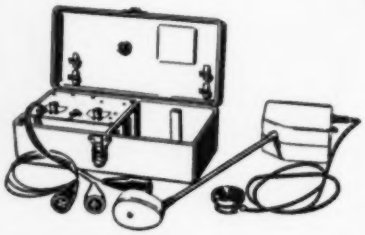


Write for Bulletin 3101.

HEINEMANN ELECTRIC CO.
140 PLUM STREET • TRENTON 2, NEW JERSEY

new equipment

(Continued from page 22)

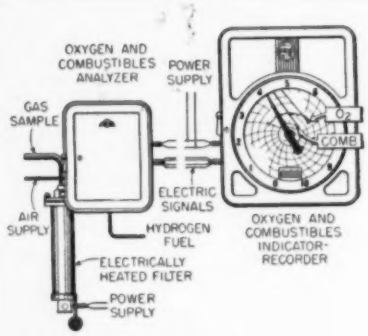


Portable unit locates faults in cable

J35 To simplify location of open-circuits or low and high resistance shorts of 10,000 ohms or less in rubber, neoprene, thermoplastic, or similar jacketed cables, Joy Manufacturing Co. has designed a lightweight fault finder. Weighing only 23 lb, the unit is ruggedly constructed and simple to operate. Both the self-contained transmitter and the receiver are powered by standard dry cells. Additional informataion is in a data sheet.

TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 123. Your requests will be handled promptly.



Gas analyzer records oxygen and combustibles

J36 Continuous and independent measurements of percent oxygen and percent combustibles are provided by a gas analyzer developed by Bailey Meter Co. The single unit with recorder indicates or automatically controls the adjustments required to maintain combustion efficiency within equipment limitations. Where fuels of varying composition are fired, the Bailey Oxygen and Combustibles Analyzer is said to save fuel dollars and act as a safety guide to prevent

(Continued on page 28)

For Features that Mean Long Valve Life and Low Cost Service Get this ALL-Purpose Edward Forged Steel Globe Valve

Edward Fig. 444-448 series, built in sizes ⅛ to 2 in. inclusive . . . forged steel globe and angle . . . 600 and 1500 lb sp . . . bolted or union bonnet . . . screwed or socket welding ends . . . Fig. 448 illustrated.

CHECK THESE Big FEATURES

- ✓ Hard bronze yoke bushing to prevent stem seizing or galling . . . lock welded to yoke
- ✓ Packing is Edward EValpak . . . heat resistant, water-proofed and die molded for long service
- ✓ Disk of EValloy 13% chromium or Stellite . . . slotted or disk nut type . . . self centering
- ✓ Tight, easily accessible bolted or union bonnet joint . . . with Ironkote gasket of 90 Brinnel max. hardness for leak-proof joint
- ✓ Heat treated forged steel inclined stem globe type body for lowest pressure loss
- ✓ Built-in pressure-tight backseat . . . permits repacking under pressure
- ✓ Roomy forged yoke . . . plenty of finger space for repacking
- ✓ Strong forged gland bolts . . . plated for long thread life

Edward Valves, Inc.
40 West 144th Street, East Chicago, Indiana

Please send literature covering your Fig. 444-B series all-purpose forged steel valves.

Name_____

Company_____

Position_____

Address_____

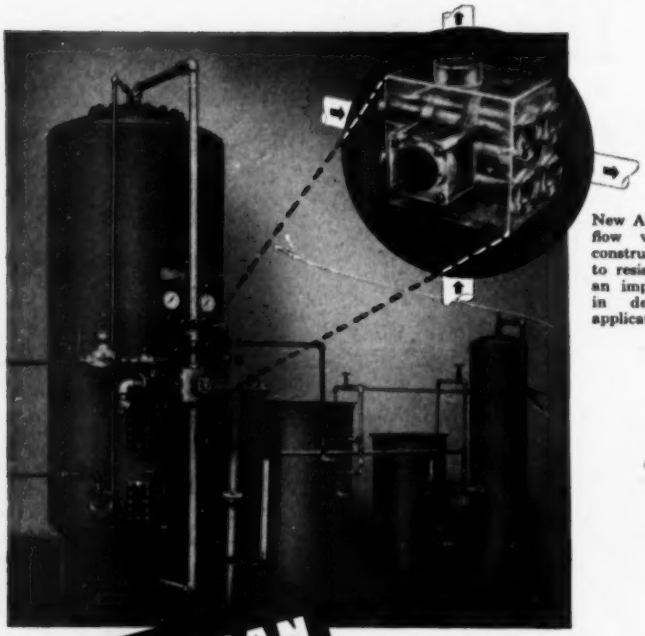
City_____ Zone____ State_____

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

an AMERICAN *process!*



New American Cycloflow valve, entirely constructed of plastic to resist corrosion . . an important feature in demineralization applications.

AMERICAN **DEMINERALIZATION**

provides water quality superior to distillation*

Where the equivalent of distilled water is required in the processing and chemical industries, American Demineralizers are providing large quantities economically and continuously.

Textile, chemical, petroleum, pharmaceutical and rubber industries have replaced distillation equipment with American Demineralizers at appreciable savings in operating cost. In power plants, American Demineralizers are used extensively for the treatment of boiler feedwater, particularly for high pressure boilers.

This process first removes the cations and converts the anions to their corresponding acids which are then removed.

This and many other American processes are the products of American leadership in water conditioning for over half a century. Contact our engineers today for the answer to your water problems.

*Demineralization does not remove bacteriological contamination.

SERVICE SINCE 1902 — AMERICAN WATER SOFTENER PATENTED — TO THE INDUSTRY

AMERICAN *Water Softener* **COMPANY**
INCORPORATED

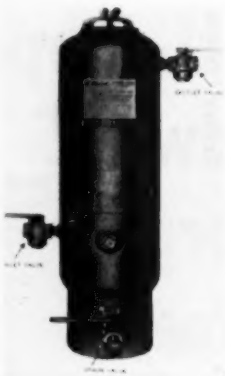
FOURTH AND LEHIGH AVENUE • PHILADELPHIA 33, PENNSYLVANIA

DEAERATORS • HOT PROCESS SOFTENERS • REACTORS • FILTERS • ZEOLITE SOFTENERS • CHLORIDE DEALKALIZERS • AERATORS & DEGASIFIERS
HYDROGEN SODIUM ZEOLITE SOFTENERS • DEMINERALIZERS • CHEMICAL FEEDERS • CONTINUOUS BLOWDOWN • SWIMMING POOL EQUIPMENT

new equipment

(Continued from page 27)

lighting off of unpurged, gas-fired combustion chambers. Accurate within plus or minus 0.25 percent by volume of sample, its range is 0 to 5 percent minimum and 0 to 25 percent maximum. Literature is available.



Dehumidifier performs over greater range

J37 To meet demands for compressed air of pure and exceptionally dry quality, Van Products Co. has redesigned its Vi-Speed Dehumidifiers. The improved models are effective over a range from 100 F to below freezing, and can operate under greater extremes of humidity and atmospheric pollution. Further information is contained in a 4-page bulletin.

TO REQUEST ADDITIONAL DATA

Insert "key" numbers on return post card found on page 123. Your requests will be handled promptly.

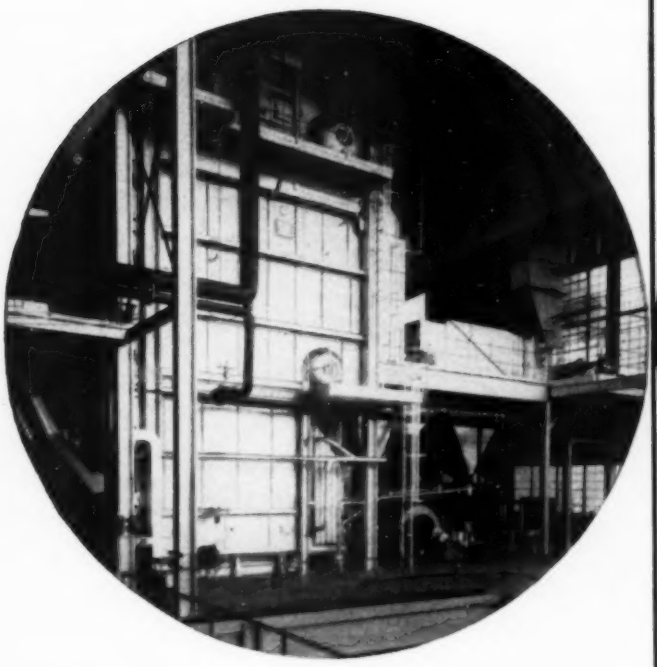
Fused seams possible with rubber film

J38 B. F. Goodrich Co. announces a rubber film which combines properties of plastics and man-made rubber and can be sealed electronically to itself. Called Vulcafilm, the material permits assembly of shapes or vessels of any size with fused, homogeneous seams stronger than the material itself. Principal use of the product has been in oil tank diaphragms developed by Hammond Iron Works. The compound which may be varied for resistance to different products, also has been used for inflatable pillows to prevent freight cargo shifting and for tank liners in cooling towers.

—End

City of Manitowoc installs fifth WICKES steam generator

To provide a dependable source of power for the City of Manitowoc, Wisconsin, the Manitowoc Public Utilities Commission has just installed a fifth WICKES Steam Generator capable of producing 175,000 lbs. of steam per hour at 525 psi. Final steam temperature is 750°F. The new WICKES Boiler has 11,600 sq. ft. of heating surface. It is equipped with an economizer and fired by spreader stoker.



R. E. Connard — Chief Engineer and General Manager

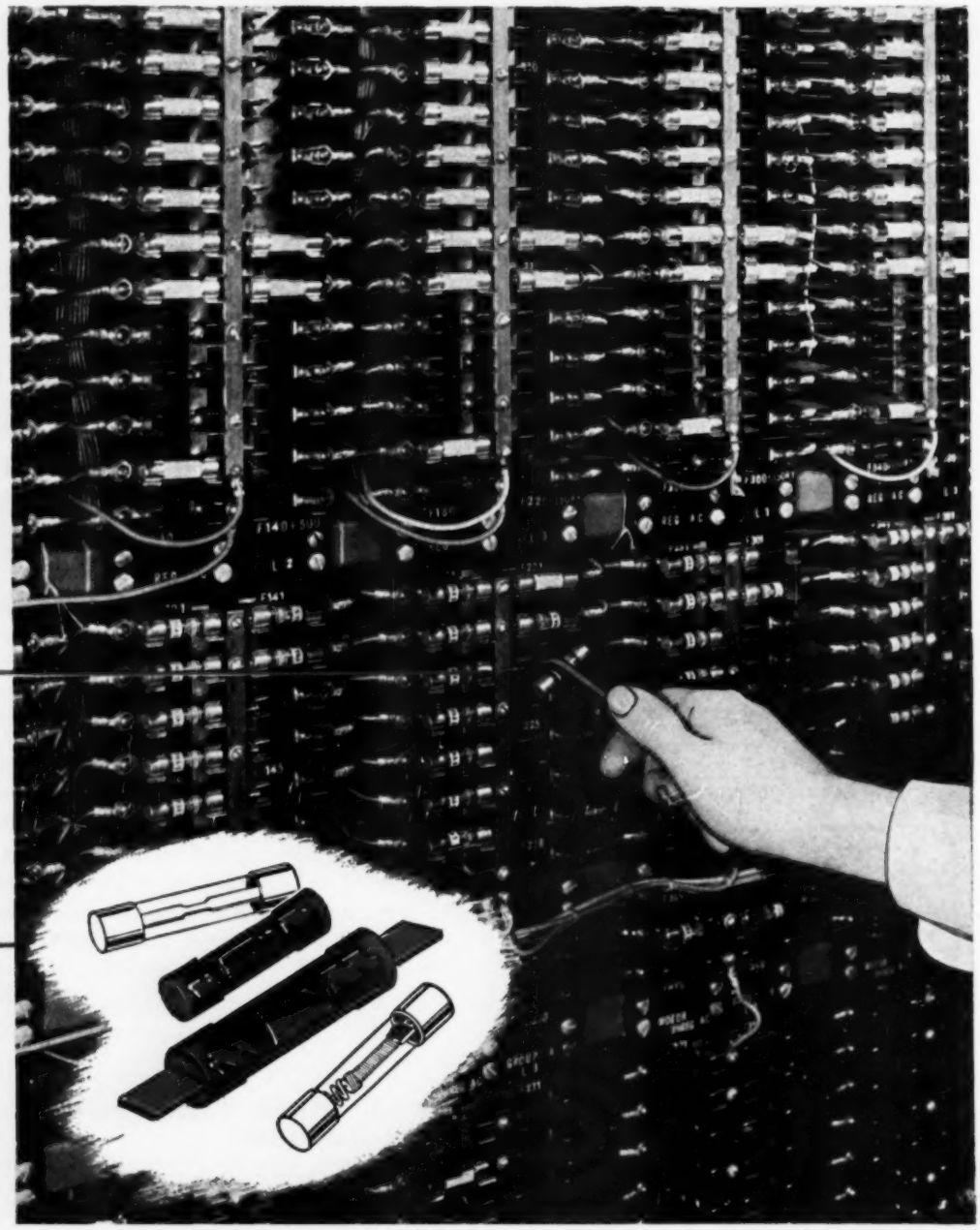
WICKES can fill your requirements for all types of multiple drum boilers generating up to 250,000 lbs. steam per hour at pressures up to 1000 psi. adaptable to any standard method of firing — oil, gas, single retort underfeed or spreader stoker. For pressures up to 900 psi. with sustained steam production up to 35,000 lbs. WICKES Type A Boilers can be shop assembled, ready for immediate installation. Write today for descriptive literature or consult your nearest WICKES representative.

THE WICKES BOILER CO., SAGINAW, MICHIGAN RECOGNIZED QUALITY SINCE 1854
DIVISION OF THE WICKES CORPORATION

SALES OFFICES: Albuquerque, N. M. • Atlanta • Boston • Charlotte, N. C. • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Wayne, Ind. • Greensboro, N. C. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Orangeburgh, S. C. • Pittsburgh • Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D. C.

150

More Than 400 FUSETRON and BUSS Fuses are used in IBM's Electronic Data Processing Machines



The new IBM electronic data processing machines, made up of eleven units, can multiply or divide more than 2,000 times a second, and add or subtract more than 16,000 times a second.

In these electronic data processing machines, protection of the intricate wiring is of the utmost importance. IBM uses between 400 and 500 FUSETRON and BUSS fuses in each of its new '701' high speed calculators.

On circuits where surge currents might cause an ordinary fuse to blow needlessly, IBM specifies FUSETRON dual-element fuses because of their long time-lag. On other circuits where no surges occur, or where even a short-lived surge might cause damage, single-element BUSS indicating fuses are used for fast opening in case a fault occurs.

When this newest and most powerful high speed electronic calculator was displayed at IBM World Headquarters on March 27th of this year, FUSETRON and BUSS fuses were one of the component parts that made the operation of this spectacular machine possible.

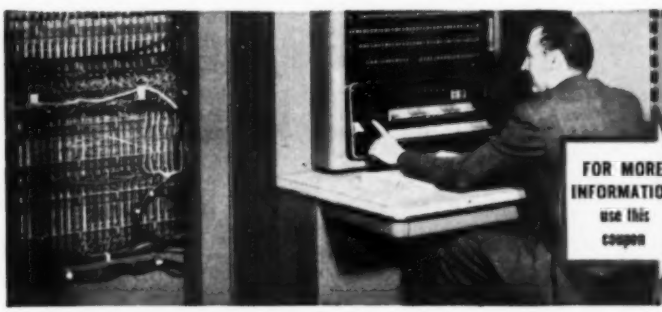
You Can Have The Same BUSS Dependability and Accuracy in Your Plant . . .

FUSETRON dual-element fuses for the protection of industrial and commercial circuits are made with the same precision demanded for this ultra-modern IBM equipment. That's why FUSETRON fuses, used throughout the entire electrical system give you a degree of protection obtained with no other device.

And, don't forget — FUSETRON fuses not only give you protection against short-circuits, they give 10 point protection: 1. Protect against short-circuits. 2. Protect against needless blows caused by harmless overloads. 3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation. 4. Provide thermal protection — for panels and switches against damage from heating due to poor contact. 5. Protect motors against burnout from overloading. 6. Protect motors against burnout due to single phasing. 7. Give double burnout protection to large motors — without extra cost. 8. Make protection of small motors simple and inexpensive. 9. Protect against waste of space and money — permit use of proper size switches and panels. 10. Protect coils, transformers and solenoids against burnout.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Start Saving With Fusetron Fuses



FOR MORE INFORMATION use this coupon

BUSSMANN MFG. CO.
University at Jefferson, St. Louis 7, Mo.
(Division of McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element fuses.

Name .....
Title .....
Company .....
Address .....
City ..... State .....

*FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

TUBELESS MAGNETIC AMPLIFIER DC SUPPLIES

for Automotive and Aircraft Industries

Sorensen Nobatrons Model MA6/15 and Model MA2850 are tubeless — using magnetic amplifier principles. They have plenty of current capacity — 100 amps at 6 volts or 75 amps at 12 volts in the MA6/15 and 50 amps at 28 volts in the MA2850. Please see the specs below.

The MA6/15 is designed primarily as an automotive production test instrument for use in checking window motors, heaters, clocks, radios, headlight dimmers, ignition systems, air conditioners, cigarette lighters. The MA2850 can be used for testing aircraft heaters, pitch changers, inverters, radar, fire control systems, etc. Built around tubeless circuits, both models are carefully engineered and built to give you years of trouble-free, dependable service. Write for information now!

SPECIFICATIONS

Model MA2850

Input voltage range	190-230, 3Ø, 4 wire, 60~
Output	28 volts DC, adjustable between 23 and 36 volts.
Current	0 - 50 amperes
Ripple	3% max RMS
Regulation accuracy	±1% against line and load combined
Time constant	0.5 seconds under worst conditions
Dimensions	15½" wide x 25⅛" high x 13" deep

Meters are standard.
Units are self contained.

Model MA6/15

Input voltage range	210-250 VAC, 1Ø, 60~
Output	Adjustable 6 - 7.7 volts DC from 0-100 amperes Adjustable 12 - 15.4 volts DC from 0-75 amperes
Ripple	1% max RMS
Regulation accuracy	±1% against line and load combined
Time constant	0.2 seconds under worst conditions
Dimensions	21" wide x 36" high x 15" deep

Meters are standard. Cabinets optional.

SORENSEN

SORENSEN AND COMPANY • 375 Fairfield Ave., Stamford 57, Conn.

letters

. . . from readers

Keeping Posted

Sir:

I came across the March, 1953 issue of your magazine which I found very enlightening, especially the article on "Control Valves and Positioners" by C. S. Beard. These articles as well as future articles in your publications are of great value in keeping everyone posted on new trends and methods in engineering. Thank you for affording me the opportunity of getting these articles.

D. M. Marshall
Staff Engineering
Babcock & Wilcox Company

I&P Goes Argentine

Sir:

We are glad to inform you that in our magazine *Ingenieria e Industria*, May 1953 issue, was published a translation of the article which appeared in INDUSTRY AND POWER entitled "Simplified Water Treatment Calculations." Thanking you once more for your kind cooperation, we remain,

Inge. Renato Montaldo
Technical Director
Ingenieria e Industria
Buenos Aires, Argentina

Selected Remarks

Sir:

. . . one of the useful magazines . . .

R. F. Throne
Superintendent
Public Service Company
Denver, Colorado

Sir:

. . . enjoy every issue . . .

C. F. Fischer
Mechanical Superintendent
Cit-Con Oil Corporation

Sir:

After I have read it (INDUSTRY AND POWER), I pass it along . . . enjoy reading it and we get a lot of information out of your magazine.

Harry Green
Power Plant Superintendent
Albemarle Paper Company

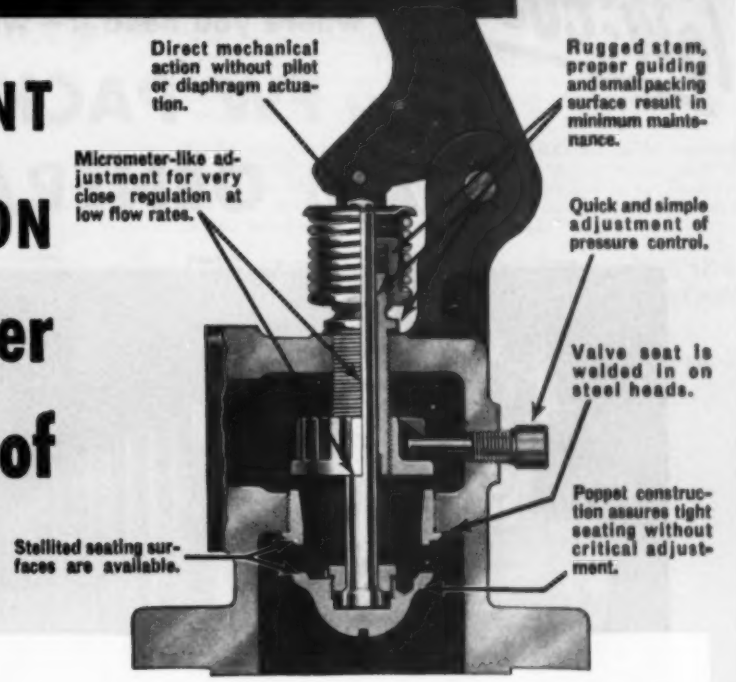
Sir:

. . . we route (INDUSTRY AND POWER) from ten to twelve people . . .

D. O. Jennings
Plant Manager
Container Corporation of America
Chicago, Illinois

POPPET TYPE VALVES

An IMPORTANT REASON for the better performance of *these* DIAMOND Blowers

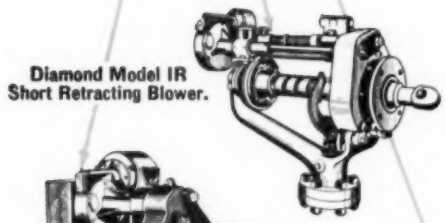

Direct mechanical action without pilot or diaphragm actuation.
Micrometer-like adjustment for very close regulation at low flow rates.
Stellited seating surfaces are available.
Rugged stem, proper guiding and small packing surface result in minimum maintenance.
Quick and simple adjustment of pressure control.
Valve seat is welded in on steel heads.
Poppet construction assures tight seating without critical adjustment.

Note carefully the important advantages pointed out on the illustration above. You will see why Diamond Poppet Type has proved its superiority by many years of successful operation on the most difficult jobs.

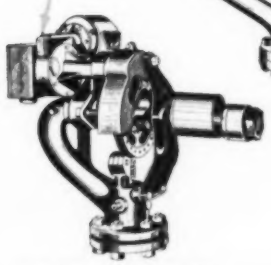
The integral adjustable pressure control device is used when boiler or header pressure is higher than desirable for blowing. Its location outside the path of valve travel permits full and immediate opening of the poppet valve, thus avoiding wire drawing.

The valve readily lends itself to examination and repair. Disc and seat are quickly accessible, and regrinding can be done quickly without dismounting the head. Seat and disc are forged and the stem rolled from stainless steel.

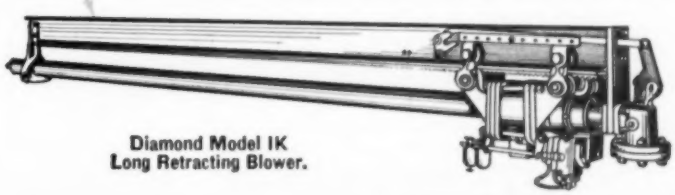
This valve construction is one of the many reasons why Diamond Blowers give better boiler cleaning at lower cost.



Diamond Model IR
Short Retracting Blower.



Diamond Model G9B
Automatic Valved Blower.



Diamond Model IK
Long Retracting Blower.

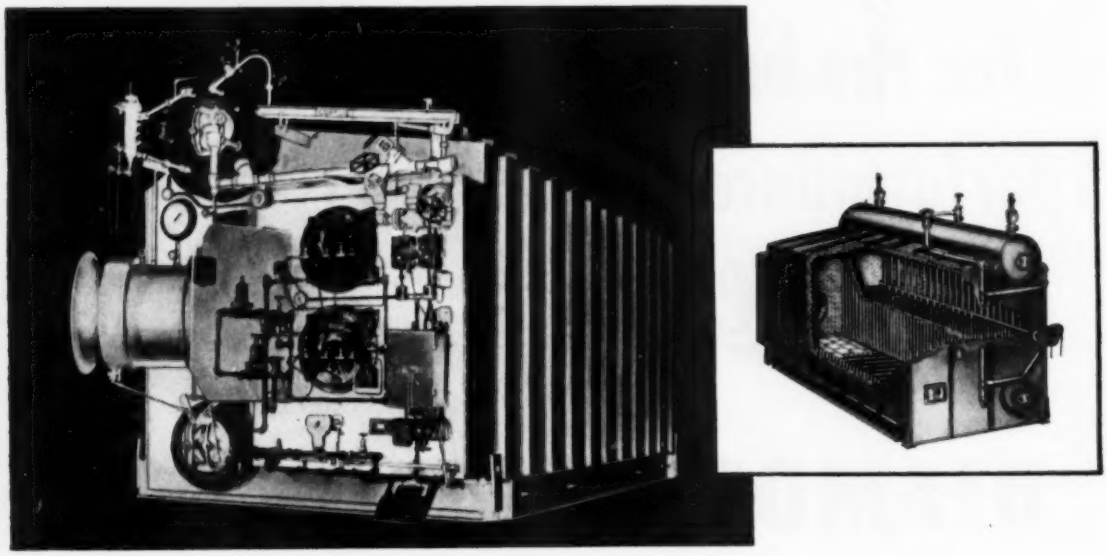
DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited, Windsor, Ontario

6258

low-cost steam

where you need it—when you need it

with the FW PACKAGE STEAM GENERATOR



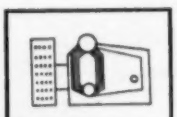
■ Foster Wheeler Package Steam Generators make it possible for you to have 7,500 to 35,000 lb of steam per hr depending on operating conditions. Standard designs for pressures of 250, 525, or 825 psi are available to meet your requirements for an economical source of steam "where you need it—when you need it."

These plant-assembled, water-tube steam generators can easily be transported to your plant by common carrier, set on a simple foundation in a minimum space at the location best suited to your needs, and quickly put in operation after a few simple service connections. For small and medium-size plants a single unit will meet your needs for low-cost heating or process steam. Large plants have found multiple-unit installations to be the economical answer to their requirements up to 150,000 lb per hr.

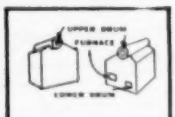
For economy in installation, operation and maintenance, the Foster Wheeler Package Steam Generator offers a combination of features which incorporate many of the improvements and technical advancements of over 50 years of experience in steam generation. For more specific information write to Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.

FEATURES THAT DISTINGUISH FOSTER WHEELER PACKAGE STEAM GENERATORS

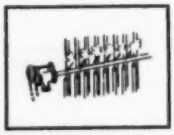
HIGH STEAM TEMPERATURES. Provisions for superheaters in some designs.



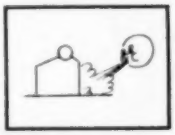
ECONOMIZERS. For larger capacity installations, package economizers can be supplied to provide minimum fuel costs.



ACCESSIBILITY. For inspection, cleaning, maintenance.



CLEAN HEATING SURFACES. Soot blowers incorporated . . . cleaning without boiler shutdown.



HEAT LOSS MINIMIZED. Minimum heat loss — from radiation and air infiltration.

RAPID LOAD SWINGS. Large diameter drums and ample furnace heating surface.

FOSTER WHEELER

INDUSTRY AND POWER'S NEW NAME CONTEST

With an announcement in the June issue, repeated in the July issue, INDUSTRY AND POWER enlisted the aid of readers in exploring possible name ideas for more specific definition of the publication's editorial service and specialized audience.

Name suggestions totalling 2,618 were entered in the contest by 534 readers. Most were interesting, many were good, a few outstandingly excellent, but the judges have reached the decision that no suggested name carries enough *additional* advantages to warrant changing.

INDUSTRY AND POWER WILL CONTINUE TO BE THE NAME OF THIS PUBLICATION

Contest Winners

FIRST PRIZE — $100.00 CASH

Name — INDUSTRY AND ENGINEERING
Won by — H. B. Hitchcock, Partner
Hitchcock & Becker
410 S. Michigan Avenue
Chicago, Illinois

SECOND PRIZE — $75.00 CASH

Name — PLANT SERVICES ENGINEER
Won by — Thomas J. Barry, Adv. Mgr.
Plibrico Company
1800 Kingsbury Street
Chicago, Illinois

THIRD PRIZE — 3-WAY TIE
$50.00 CASH TO EACH WINNER

Name — ENGINEERED PLANT SERVICES
Won by — W. J. Neely, Plant Engineer
W. T. Rawleigh Company
Freeport, Illinois

Earl R. Nunemaker, Chief Power Engineer
Linde Air Products Company
East Park Drive
Tonowanda, New York

Walter B. Mueller, Industrial Press Section
Allis-Chalmers Mfg. Co.
Milwaukee 1, Wisconsin

Duplication of Entries: Contest Rule 5 provided: "If winning name or either one of the two selected as second and third best is submitted by two or more readers, award in each case will be made to that entry postmarked earliest." All three winning names were sent in by more than one contestant, and the awards have been made in accordance with Rule 5. The name winning Third Prize was sent in by the three tied winners named above, their entries all being postmarked the same day.

A SINCERE Thank You

We are grateful to all readers who submitted name suggestions and also to those who offered their views on the subject of trying to find a new and more definitive name.

In total, the response from INDUSTRY AND POWER readers is gratifying not only because so many cooperated by sending in such a large number of suggestions—nearly 3,000—but also because these suggestions clearly reflected such a wealth of thought and willingness to be helpful.

INDUSTRY AND POWER
ESTABLISHED 1920
420 Main St., St. Joseph, Mich.
For Executives and Engineers
Responsible for Engineered Plant Services

I&P

READ THE EDITOR'S MESSAGE ON OTHER SIDE

The Magazine for Executives and Engineers Responsible for Engineered Plant Services

MEMBER
CONTROLLED CIRCULATION AUDIT, INC.
NATIONAL BUSINESS PUBLICATIONS, INC.

INDUSTRY AND POWER
FOUNDED 1920
420 MAIN STREET · ST. JOSEPH, MICHIGAN

INDUSTRY AND POWER'S EDITORIAL PROGRAM
RESOUNDINGLY APPROVED

An Open Letter to Readers from the Editor

As indicated on the foregoing page, we have canvassed the possibility of renaming INDUSTRY AND POWER and have received nearly 3,000 interesting name suggestions; but we've decided not to change the name.

In addition to the name suggestions, we received a flood of comment from readers saying in effect: "Please don't change the name. We like the present name and the publication. They're both good."

But from the Editor's point of view, one of the most interesting reactions to the Name Contest was the note of concern evidenced by so many readers who feared we might be planning to alter INDUSTRY AND POWER's editorial program.

We had no intention of doing so, but the fact that such a large number of readers feared we might and urged us not to is extremely interesting. It presents strong evidence of the soundness and acceptability of the editorial program which has set this publication apart from the average magazine dealing with industrial engineering subjects.

Our readers, you men responsible for Engineered Plant Facilities in American industry, have endorsed INDUSTRY AND POWER editorially. We, of the editorial staff, take it as an inspiration to exert even greater effort to serve you well.

We pledge ourselves to bring you the best, which means careful selection of material you can use and continuation of our policy of avoiding those types of material not needed in your work. Our articles and departments in the future, as in the past, will be pinpointed most carefully, and, to conserve your time, they will be held to minimum wordage consistent with the thoroughness, accuracy, and clarity you have come to associate with INDUSTRY AND POWER material.

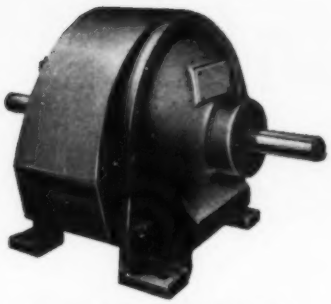
My editorial associates and I are grateful to you for this fine vote of confidence and approval.

Sincerely yours,

Hunter Hughes

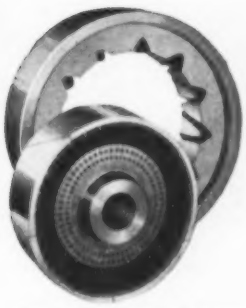
Hunter Hughes/mc

Editor

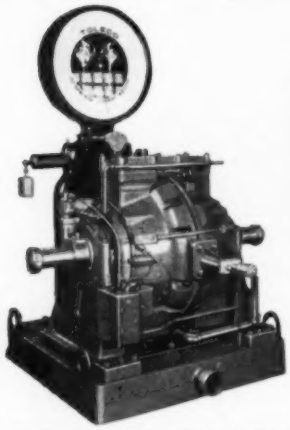


AIR COOLED COUPLINGS

AJUSTO-SPEDE MOTORS



AIR COOLED BRAKES



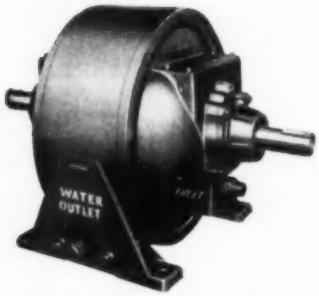
ABSORPTION DYNAMOMETERS

EATON

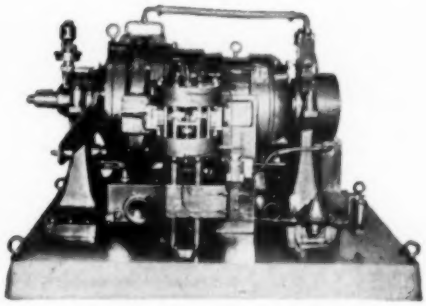
DYNAMATIC

EDDY-CURRENT ROTATING EQUIPMENT

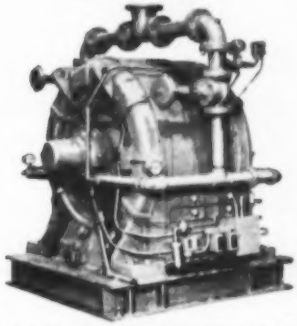
PRESS DRIVES



LIQUID COOLED COUPLINGS



UNIVERSAL DYNAMOMETERS



LIQUID COOLED BRAKES

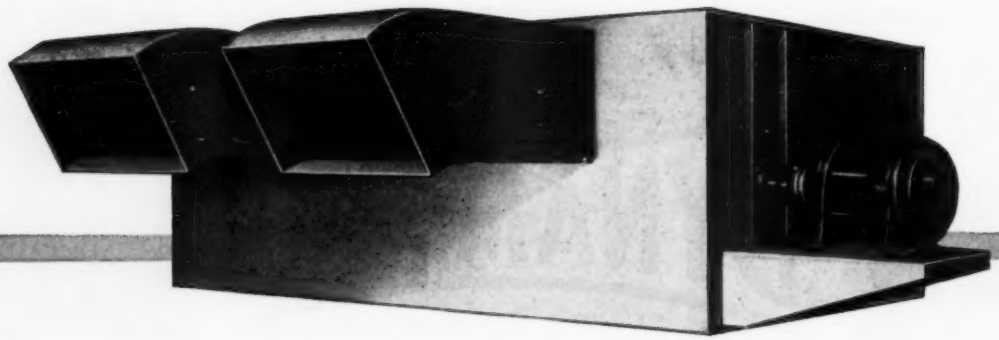
Dynamatic Eddy-Current electro-magnetic equipment represents the ideal solution for a wide range of adjustable-speed drive problems, particularly where an AC power source is a requirement. Typical applications include paper machine drives, cement mill drives, industrial truck clutches, press drives, crane brakes, fan drives—in fact, practically all test, processing, and conveying equipment common to industry. Instantaneous response and accurate control are important advantages.

Write for your copy of Bulletin GB-1 which describes and illustrates the basic Dynamatic units.

DYNAMATIC CORPORATION KENOSHA • WISCONSIN

Subsidiary of EATON MANUFACTURING COMPANY, Cleveland, Ohio

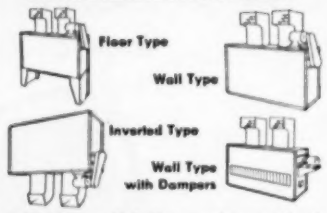
Here's why Trane Torridors can be tailored to fit so many heating jobs!



These *standard* TRANE accessories can be combined with any *standard* TRANE Torridor to solve any heating, ventilating, air filtering or process problem.

- **Many coil types . . .**
  High or low pressure steam—Hot water —Standard or "non-freeze" SD type
- **20 Nozzle arrangements**
- **Wide choice of filters and frames**
- **Two types of by-pass dampers**
- **Mixing and intake boxes**

4 More Standard Torridor Models



And 5 Trane Unit Heaters for spot heat where and when you need it.

How you can have Engineered Heating to solve problems like these with a standard TRANE Torridor!

1. Drafty doorways. Use basic Torridor heating section with nozzles and door switch. Positive blanket of heat every time door opens.

2. Negative pressure. Use Torridor with SD "non-freeze" coils and filter section to introduce fresh tempered air. Maintain positive pressure. Eliminate cold air leaks.

3. Close temperature control. Use Torridor with face-and-by-pass and/or modulated steam distributing coils. Tempers chilly morning air . . . permits mild midday air to enter without overheating.

4. Explosive atmosphere. Use Torridors with spark-resistant fans and explosion-proof motors. Many other variations available.

5. Need for quick warm-up. Use mixing box on Torridor. Fresh air dampers close for quick warm-up—modulate to mix ventilation air with room air.

6. Process heating or drying. Torridor has ample room for three rows of high output coils for process heating or drying applications.

7. Compact central system. The powerful centrifugal fans of the Torridor can deliver large quantities of air through duct systems.

8. Ventilation. Use Torridors for ventilation all year. In the summer, Torridors circulate outside air. In the winter, tempered air.

Problems of fog removal, ice melting, drying, curing and many others can be solved with TRANE Torridors . . . automatically, with standard pneumatic or electrical controls. See your consulting engineer or TRANE office. Write TRANE, La Crosse, Wis., for Bulletin DS-327A.

TRANE Torridors

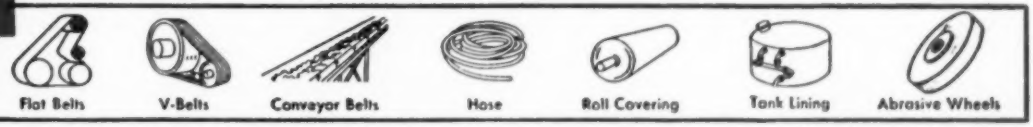
The Trane Company, La Crosse, Wisconsin • East. Mfg. Div., Scranton, Pennsylvania
Trane Company of Canada, Ltd., Toronto • 80 U.S. and 14 Canadian Offices

TRANE— MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

MORE PULL IN EACH PLY . . . . When Condor Compensated Belt rounds the pulley every ply is under uniform tension (illustration, right). There are no "loafing" inner plies or over-worked outer plies to rupture and start belt failure (illustration, left). This exclusive R/M method of equalizing ply stresses was developed by R/M engineers to eliminate fastener troubles and ply separation. A selection of driving surfaces for various tension requirements is available. This all adds up to MORE USE PER DOLLAR. Ask the R/M distributor for Bulletin 6808. He can also help you get MORE USE PER DOLLAR with R/M hose, conveyor and V-belts.

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Packings • Brake Linings • Brake Blocks
Clutch Facings • Asbestos Textiles • Sintered Metal Parts • Bowling Balls MR-910

Looking for the right packing for your centrifugal pumps?

For shaft speeds to 1750 RPM Johns-Manville Centripac seals better

WEAR on centrifugal pump shafts as well as on oscillating and rotating rods of other equipment is minimized by J-M Centripac. This is because the square cross section of this packing provides the maximum contact surfaces. Thus, it insures a tight seal with the least friction and gland pressure.

Because Centripac is plaited square it retains its shape indefinitely, thus maintaining maximum surface contact for long periods of time. It is made from long-fiber asbestos yarn, thoroughly lubricated and graphited. It seals against fresh or salt, hot or cold water, oil, ammonia, brine, gasoline, and certain weak acids and other chemicals. Because of its wide application, it is a favorite of plant men everywhere.

For general service, Style #7 Centripac is recommended. It contains no wire, is soft enough to conform readily to the packing space, and stands up well in service. It comes in coil form, Style #C-7 and Ring form, Style #R-7. Sizes 3/16" and up.

For higher shaft speeds, J-M Plastic Packings reduce friction and scoring of shafts and sleeves

Higher centrifugal pump speeds make friction increasingly important in packing and shaft life. That is why J-M Plastic Packings have been designed to have the homogeneous structure and low friction so essential to long packing life in this service.

The exact composition of these packings varies according to the service conditions for which each particular style is designed. As an example, one of these, Style No. 610 is an excellent general maintenance packing for service against steam, air, ammonia, gases, etc. up to 550F. It is made of selected asbestos fiber mixed with pure graphite and a small amount of non-friction metal, then bonded with a heat-resisting compound to form a pliable coil or spiral. It is furnished in sizes of 1/8" and up.

YOUR J-M PACKING DISTRIBUTOR will gladly recommend the right packing for your equipment, and furnish it from stock for your immediate requirements. Write Johns-Manville, Box 60, New York 16, N. Y. for his name and address. In Canada, 199 Bay St., Toronto 1, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS and GASKETS

NEW BOILER WATER CONDITIONING PACKAGE

Adjust-O-Feeder
Model 1105-S

- **LOW COST**
- **COMPACT**
  Built-in standard motor — no separate gearbox or couplings.
  Built-in oil-enclosed gear reducer.
- **MICRO-STROKE ADJUSTMENT**
  Scale easily read — crank and connecting rod operate in horizontal plane.
- **LONG LIFE AND EASY MAINTENANCE**
  One-piece Meehanite iron frame for positive alignment of all moving parts.
  Double check valves on suction and discharge easily removable.

This new, compact chemical feed pump, by %Proportioneers, Inc.%, is inexpensive and provides accurate boiler water treatment for plants where a low capacity, medium pressure pump will meet requirements. The standard Model 1105-S has a capacity range from 1 to 10 GPH and will discharge against pressure up to 650 psig. For lower feeds, the unit is available with a range of from 0.5 to 5 GPH. Complete and self-contained, Model 1105-S weighs less than 100 lbs. and is ready to operate.

Ask for Bulletin 1105

% PROPORTIONEERS, INC. %

Write to %PROPORTIONEERS, INC.%, 357 Harris Ave., Providence 1, R. I.

Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

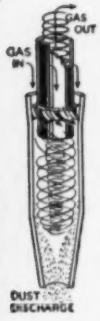
No wonder "MULTICLONE" is the leading name in the centrifugal recovery of fly ash from all types of gases, hot or cold.

No other mechanical recovery equipment has so many years of fly ash recovery experience behind it . . . or has such uniformly high collecting efficiency . . . or provides so many other money-saving, space-saving advantages as MULTICLONE. The four advantages outlined below are by no means the complete MULTICLONE story, but are typical of the vital savings found *exclusively* in MULTICLONE equipment . . .

In fly ash recovery

MULTICLONE COLLECTORS

***and only Multiclones* give vital advantages like these . . .**



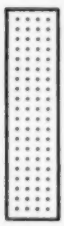
Uniformly High Recovery:

MULTICLONE's multiple *small diameter* tubes—made possible by its exclusive vane design—whirl the dirty gases with greater centrifugal force, thus throwing out not only the large, medium and small particles, but also a high percentage of the *extremely small* particles of 10 microns and less. This, coupled with the fact that there are no pads or filters to become choked with recovered material, results in a more complete recovery of *all* suspended materials from the gas stream.

Space-Saving Compactness:

Plant space costs money—so be sure to check space requirements carefully. As shown in the accompanying chart, the MULTICLONE requires less floor space and less cubic space than any other unit of comparable capacity and performance. Translate these savings into today's high costs for plant space and you readily see the great importance of this one MULTICLONE advantage alone!

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9



Long and narrow

Square

Maximum Adaptability:

In addition to its unusual compactness, the MULTICLONE is also unusually adaptable to various installation requirements. Where head room is low it can be installed with side-inlet side-outlet connections. Where side clearances are restricted, it can be installed with side-inlet top-outlet connections. In addition, without changing capacities, the shape of the unit can be varied—long and narrow, short and wide, or square—to fit restricted spaces . . . and its single-inlet single-outlet duct requirements permit greater flexibility and simpler installation. These savings slice installation costs, space requirements and insulating expense.

Minimum Maintenance:

The MULTICLONE has no high speed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. MULTICLONE draft losses remain uniformly low *at all times*. Further, the recovered material from an entire bank of tubes is collected in a *single* hopper—far easier to service and maintain than the multiple hoppers of conventional cyclone units.

FREE INFORMATIVE BOOKLET
This 32 page booklet outlines the basic principles of centrifugal dust recovery and shows the many ways MULTICLONE advantages assure higher recovery at lower overall costs. A free copy of this booklet will gladly be sent on request. Write today!

Before you decide on any recovery equipment be sure to get complete information on MULTICLONE advantages. A letter, wire or phone call to our nearest office places this information in your hands without obligation. Get all the facts and you will get MULTICLONE Collectors!

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1026 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
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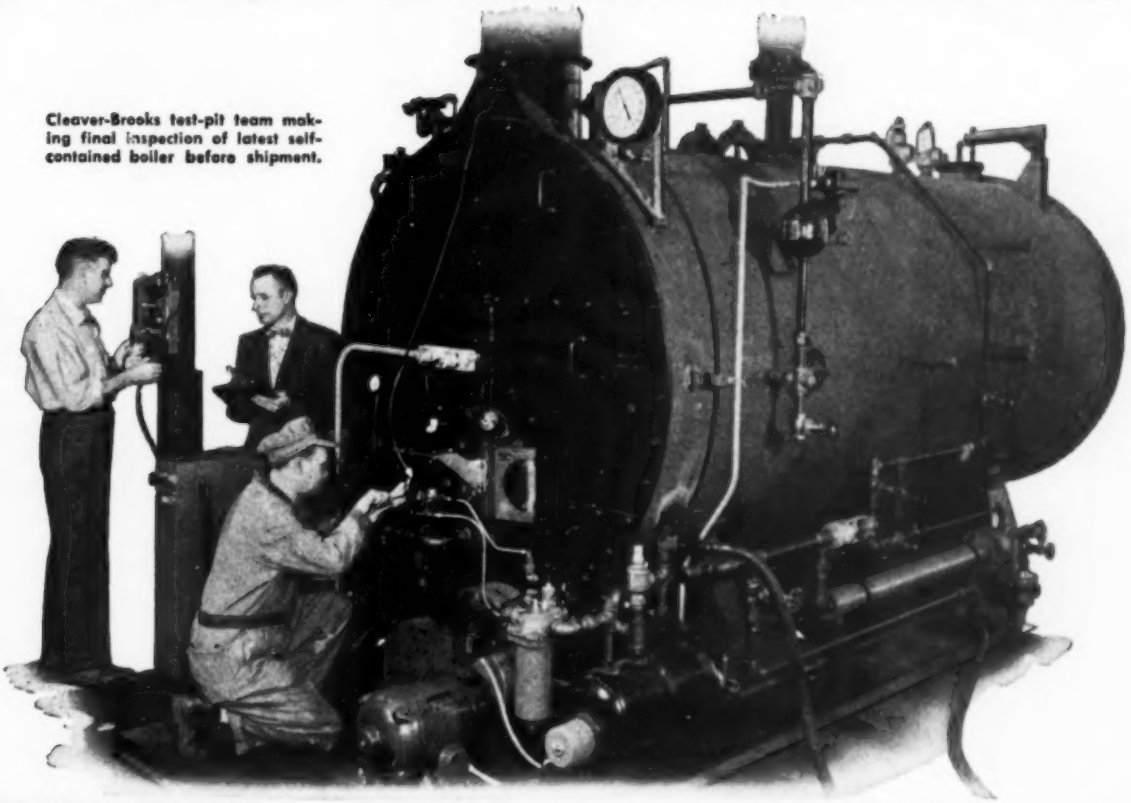
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

their counterpart "Test-Pilots" have at Cleaver-Brooks



Cleaver-Brooks test-pit team making final inspection of latest self-contained boiler before shipment.

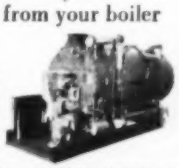
HIGH SCORES . . . on factory and on-job tests guarantee greatest return from boiler investment

When test pilots give the familiar "O.K." — that's the sign of proven performance. It's the same with boilers in the Cleaver-Brooks plant. Only after accurate, thorough inspection and testing under actual operating conditions do boilers get the final "O.K." from experienced test engineers. That's why you get guaranteed 80% efficiency from your Cleaver-Brooks boiler.

A record of this test is available to every buyer on request. In fact, you as a buyer, consultant, or contractor are invited to witness the actual test on your Cleaver-Brooks boiler before shipment.

And further, Cleaver-Brooks boilers are placed in operation at the job site by factory service engineers who check installation, train your operators and make complete and detailed field tests.

So, when you buy a boiler, insist on factory tests as well as field service tests by qualified engineers. There is no better way of insuring yourself of the very best value money can buy and the greatest return from your boiler investment. Look to Cleaver-Brooks, the leader in the "Packaged" Boiler field for two decades. Write today for latest Catalog AD-100.



Available for oil, gas and combination oil/gas firing.

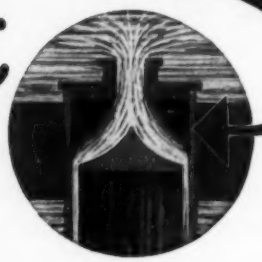
CLEAVER-BROOKS COMPANY
Dept. K, 303 E. Keefe Ave.
Milwaukee 12, Wisconsin, U.S.A.

Cleaver-Brooks
Originators of the Self-Contained Boiler

BOILERS — STEAM OR HOT WATER — FOR HEATING AND PROCESSING IN SIZES FROM 15 TO 500 HP, 15 TO 250 PSI

Dirty Water can't "Shut-down"...

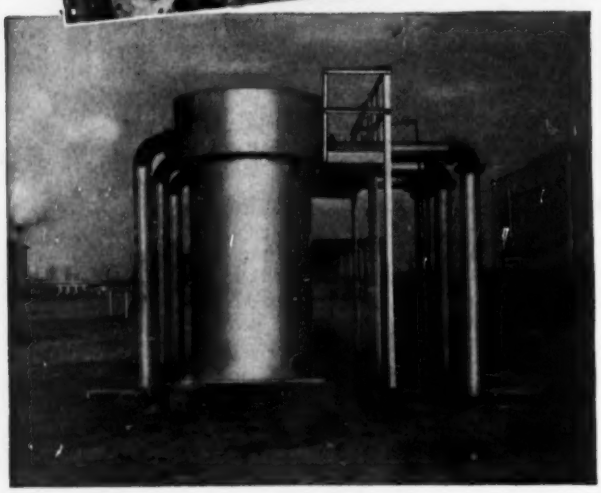
Vogt



film type exchangers

(Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424,441



River water, well water or brackish water are all alike to this exchanger *because it can be cleaned* while in operation! The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

TOP: *Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.*

BOTTOM: *Jacket Water Coolers serving engines of 7,300 HP in the compression plant of a Western Oil Refinery.*

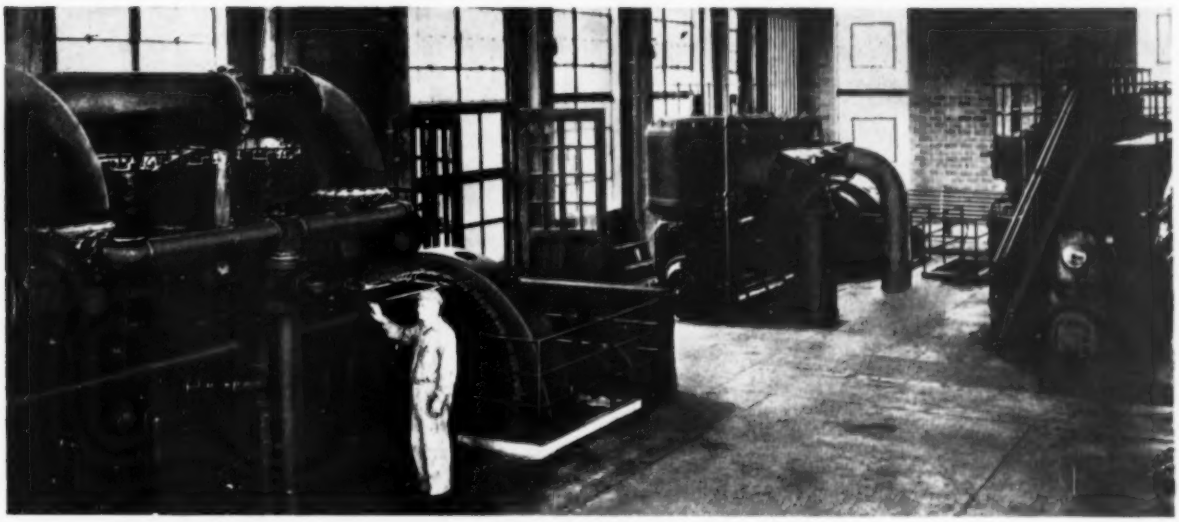
[Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request.]

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

H. L. Ostness, Chief Engineer, River Falls Municipal Utility, Wisconsin, says...

"Sticking Rings are no problem in this Plant"



Mr. Ostness, as chief engineer of one of the oldest Municipal Power Plants in Wisconsin, knows diesels – *knows how to get the most out of them.* Mr. Ostness recently wrote, "We have used Sinclair Lubricants for over fifteen years very successfully. GASCON® and RUBILENE® H.D. have been doing an outstanding job in our diesels. Stuck rings is a trouble we know nothing about – engine wear is at an absolute minimum. With results like these, we'd recommend Sinclair Lubricants any time."

If your present lubricants do less, why not let Sinclair help you get longer life from your diesels – with less trouble. Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

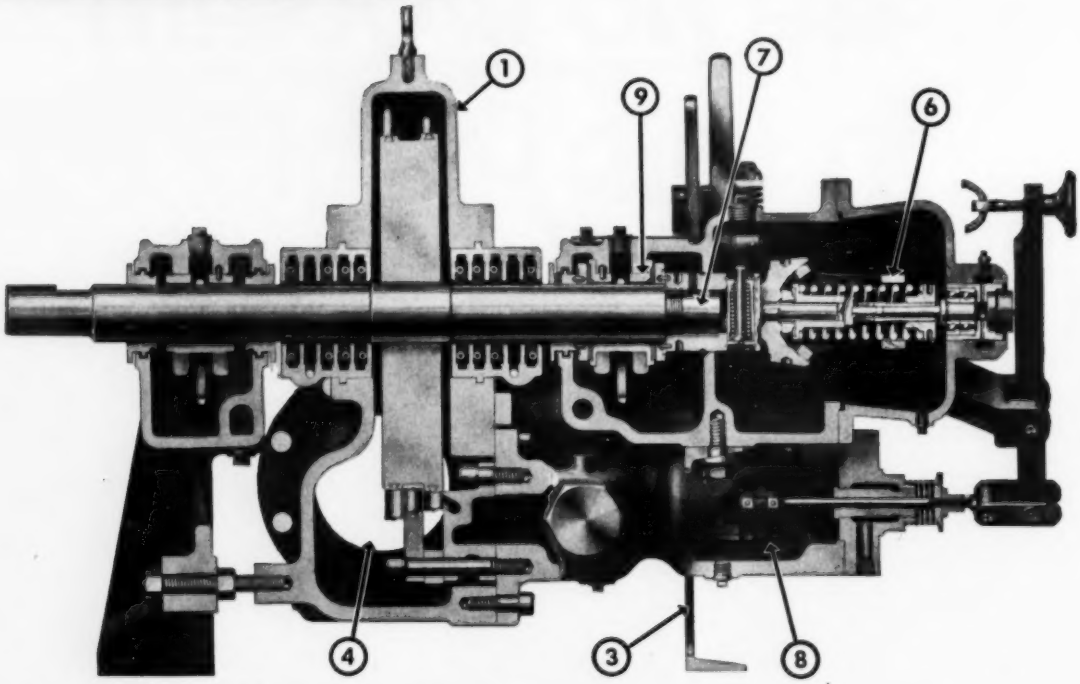
save wear and replacement

NEW DE LAVAL

HCB

SINGLE STAGE TURBINE

can be ordered from stock



1 Case and Cover Split Horizontally on centerline for ease of maintenance.

2 True Centerline Casing Support assures distortion-free radial expansion. *Not shown.*

3 Flexible Support at governor end provides for axial expansion.

4 Exhaust Opening either right or left side for installation flexibility.

5 Steam Strainer, protecting trip and governor valves, is *removable* for cleaning without breaking steam connections. *Not shown.*

6 Constant Speed Governor features governor weights pivoted around frictionless surfaces.

7 Complete Governor Assembly is now *replaceable as a unit.*

8 Balanced Single Seated Main Governor Valve has proportional flow characteristics for sensitive, positive control.

9 Shaft Locating Bearing of adjustable double collar type.

Horsepower: 100 MAX
Steam Pressure: 300 PSIG MAX
Steam Temperature: 550F MAX
Exhaust Pressure: 25 PSIG MAX
Speed: 4,000 RPM MAX
Steam Inlet: 2"–250# ASA FLG.
Exhaust: 6"–150# ASA FLG.
Weight: 1,200 LB.

Here's the new De Laval HCB Single Stage Turbine which is now "on the shelf" . . . ready for immediate shipment. This mechanical drive turbine is simple, rugged, designed for long economical life and low maintenance. For example, note the true centerline casing support, the replaceable governor, the removable steam strainer. Investigate all the advantages of this versatile driver. It is ready to handle—*at low cost*—a variety of applications in your plant.

Send for new Bulletin 4206
which gives vital facts and figures

DE LAVAL *Mechanical Drive Turbines*

DE LAVAL STEAM TURBINE COMPANY
857 Nottingham Way, Trenton 2, New Jersey

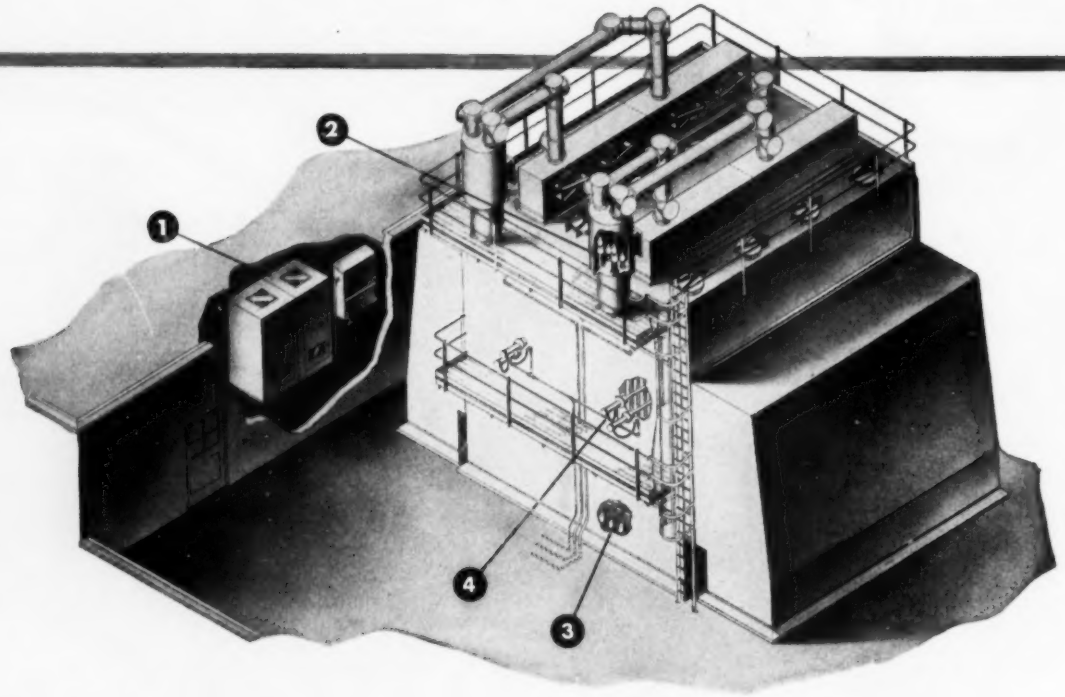
DL 505

John Zink and his engineers solve an old and vexing problem by providing combustion without smoke in the modern Smokeless Field Flare Burner. John Zink Burners are protected by more than 50 U. S. Letters of Patent.

JOHN ZINK COMPANY

4401 South Peoria Tulsa 18, Oklahoma

What's New in Electrical Precipitators?



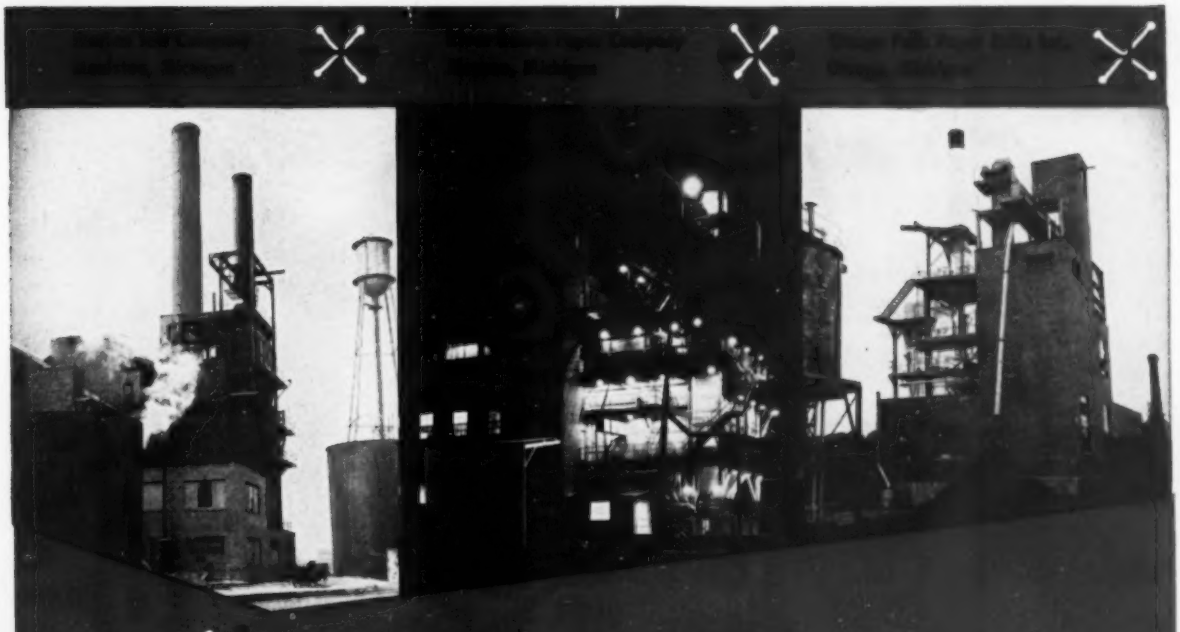
FEATURES:	RESULTS:
1. Remote Control—Entire installation is operated by switchboard control from any convenient location.	**1.** Central control room operator can see all meters and operate all controls that determine optimum performance.
2. Low-cost Energization—Weatherproof high voltage transformer and electronic tube rectification equipment allow location flexibility and minimum power consumption.	**2.** Space conservation, short high voltage connection between rectifiers and precipitators insure compact, economical installation.
3. Unique Electrode Design—Plumb-bob discharge electrodes, individually weighted to remain taut, are uniformly positioned by a lower framework.	**3.** Discharge wires are kept perfectly aligned at all times for maximum overall precipitator performance.
4. Electronically Controlled Rapping—New magnetic impulse rappers are designed for continuous, sequential, smoothly regulated electrode rapping.	**4.** Eliminates stack puffs and produces increased overall efficiency.

Ask your Research Corporation representative to bring you up to date on the details of these and many other improvements that you will find in the modern Cottrell Electrical Precipitator.

RESEARCH CORPORATION

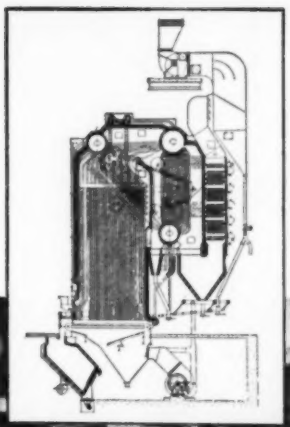
405 Lexington Avenue, New York 17, N. Y.
Bound Brook, N. J. • Grant Building, Pittsburgh 19, Pa.
122 South Michigan Avenue, Chicago 3, Ill.

RC143



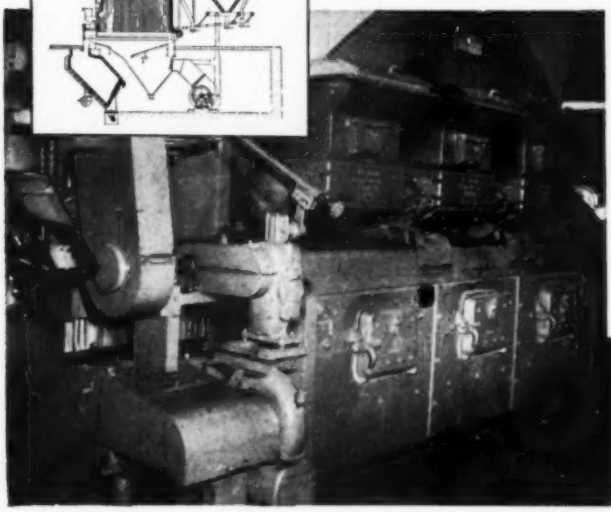
Selected for "SEMI-OUTDOOR" Boiler Plants

DETROIT ROTOGRATE STOKERS



AT OTSEGO

75,000 pound unit with superheater and economizer. 650 pounds pressure 750° F steam temperature. Based on Ohio Strip Mine coal—10,800 BTU.



Savings in building structure costs are substantial. May run as high as 15% of the total investment in the boiler, stoker and accessories, according to Cummins & Barnard Inc., Consulting Engineers, Ann Arbor, Michigan.

Here are representative RotoGrate "semi-outdoor" installations made under the direction of these Engineers.

Detroit RotoGrate Stokers

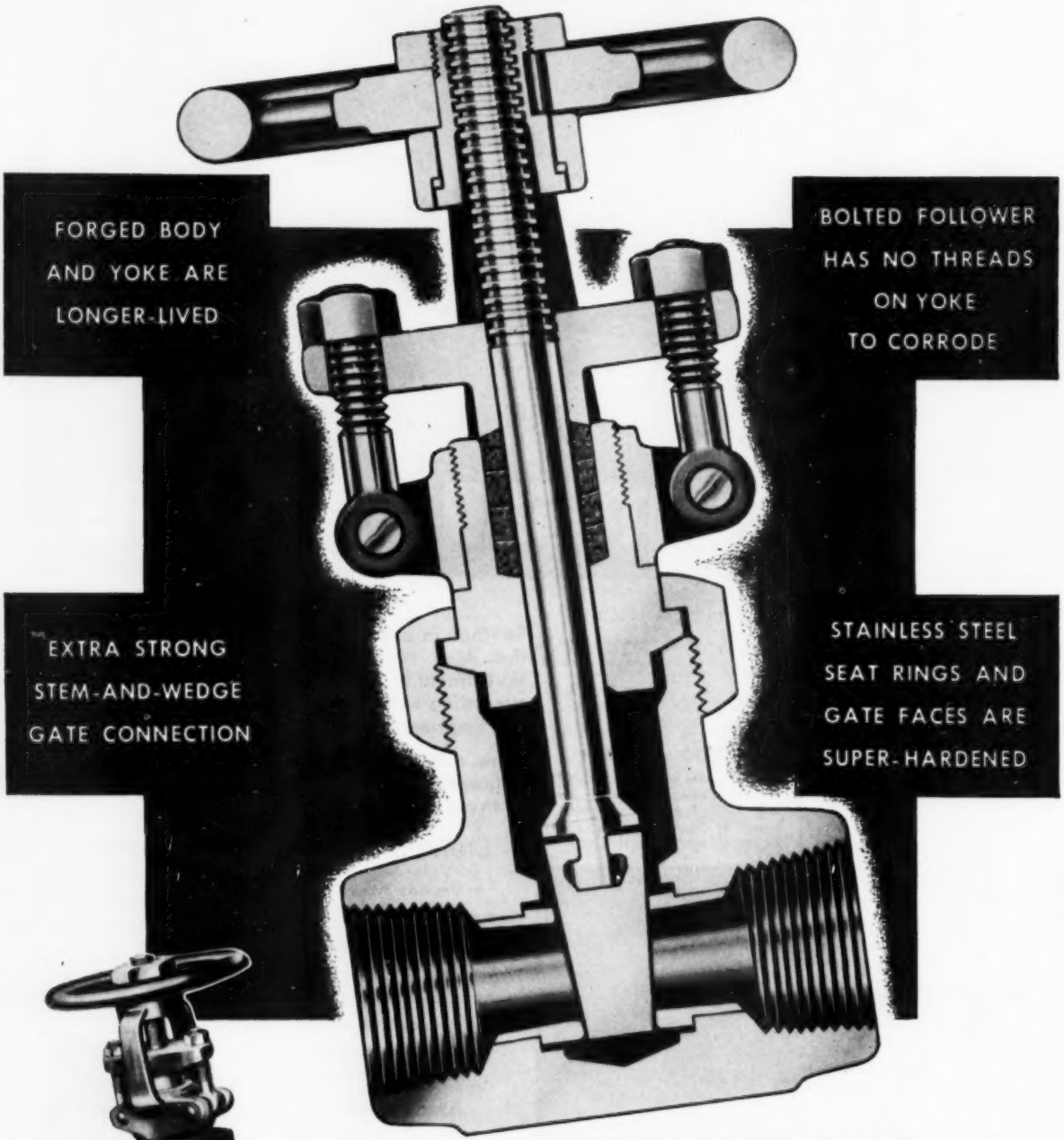
- **Provide More Capacity**
- **With High Thermal Efficiency**
- **Readily Applied**
- **Burn Wide Range of Fuel**
- **Exceptionally Dependable**
- **Reduce Steam Costs**
- **Maintenance Low**

Investigate now.
No obligation—write:

DETROIT STOKERS

DETROIT STOKER COMPANY

Here's where CHAPMAN LIST 960... *gets all that Extra Strength*


FORGED BODY AND YOKE ARE LONGER-LIVED
BOLTED FOLLOWER HAS NO THREADS ON YOKE TO CORRODE
EXTRA STRONG STEM-AND-WEDGE GATE CONNECTION
STAINLESS STEEL SEAT RINGS AND GATE FACES ARE SUPER-HARDENED
CHAPMAN

These hyper-husky, small forged carbon or alloy steel gate valves come in sizes from ¼″ to 2″ inclusive... with choice of rising stem with yoke (shown), or with inside screw . . . and with choice of bonnet joints either gasketed or metal-to-metal. Pressure range: 2,000 lb. at 100°F. — 380 lb. at 1,000°F . . . if any higher, specify List 990. Send for Catalog 10.

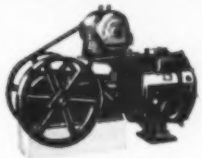
· The Chapman Valve Mfg. Co.

INDIAN ORCHARD, MASSACHUSETTS

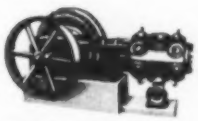
HEAVY-DUTY
"ES" COMPRESSORS

provide maximum efficiency in a WIDE RANGE OF APPLICATIONS

. . . with unusual flexibility of drive and cylinder arrangements



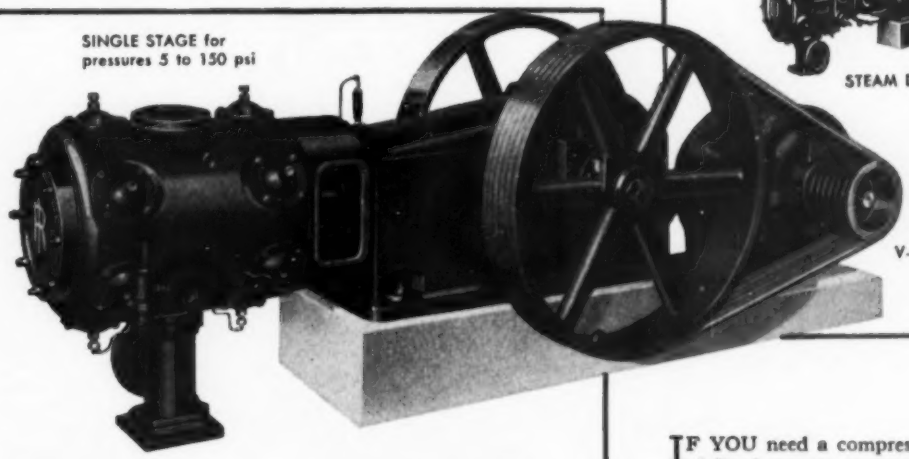
OVERHEAD MOTOR



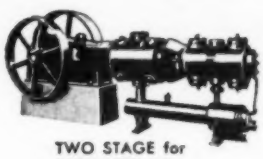
DIRECT-CONNECTED SYNCHRONOUS MOTOR

STEAM DRIVE

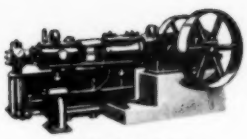
SINGLE STAGE for pressures 5 to 150 psi



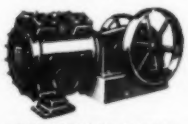
V-BELT DRIVE



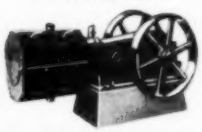
TWO STAGE for 150 to 500 psi



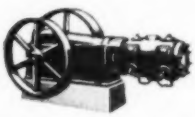
THREE STAGE for 500 to 2500 psi



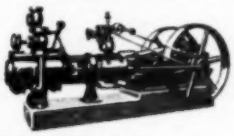
DRY VACUUM PUMPS . . . single or two stage



STEAM-PRESSURE BOOSTERS



NON-LUBRICATED CYLINDERS for oil-free air or gas



REFRIGERATION UNITS for ammonia or other refrigerants

IF YOU need a compressor for any of the following purposes you should consider the Type "ES" compressor . . . a standardized, yet extremely flexible compressor built by Ingersoll-Rand, the pioneer compressor builder.

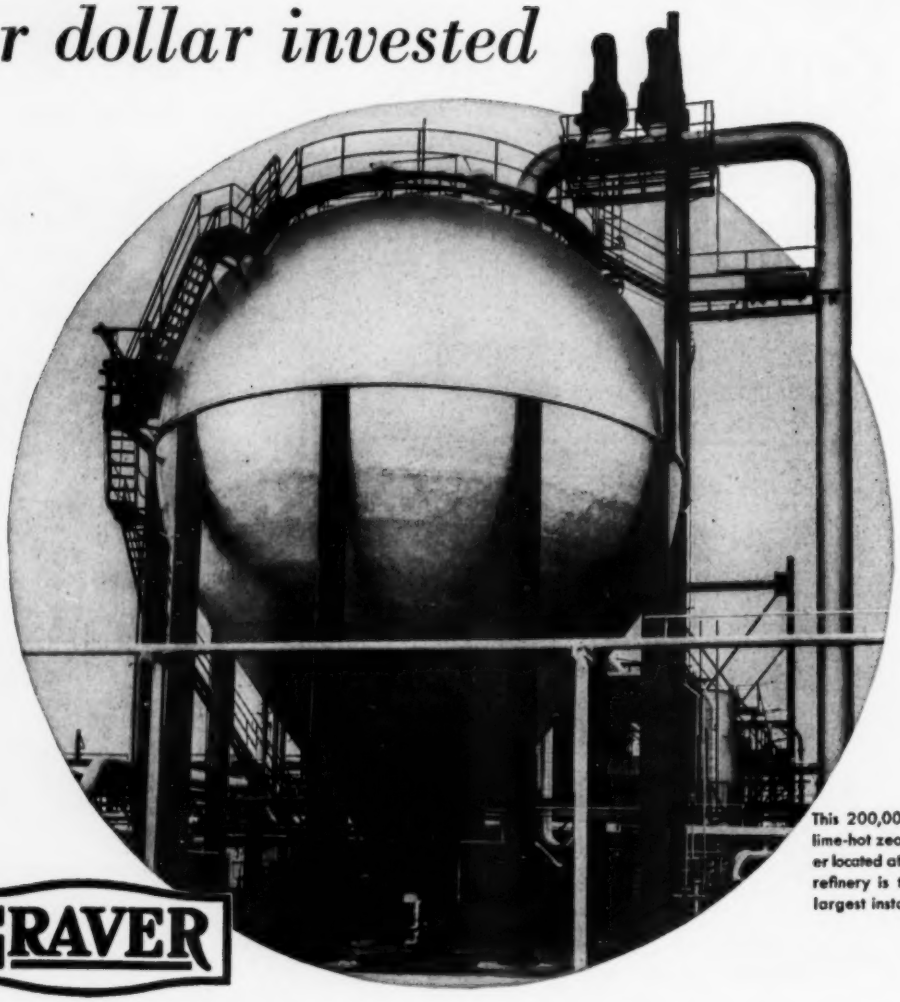
- To compress air or gas to any pressures between 5 and 2500 psi, or for pulling vacuums. (Stock cylinders are normally available for all frame sizes, see illustrations.)
- For capacities requiring from 5 to 125 horsepower. (Six frame sizes are available.)
- For continuous full-load operation day after day, week after week.
- For handling poisonous, inflammable, or other gases where leakage must be avoided.
- Where compressed air or gases must be free of all traces of oil. (Type NL cylinders require no oil, glycerine, grease or water for lubrication.)
- Where a future change in pressure conditions may call for a change in cylinder sizes.
- Where power cost is an important factor.
- To act as an economical standby unit for larger compressors whose full capacity is not required at all times.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. *Offices and Agents throughout the World* 859-1

COMPRESSORS • TURBO-BLOWERS • ROCK DRILLS • AIR TOOLS • CENTRIFUGAL PUMPS • CONDENSERS • OIL AND GAS ENGINES

Clearest Water per dollar invested



This 200,000 gph hot lime-hot zeolite softener located at an eastern refinery is the world's largest installation.

GRAVER

SPHERICONE *Hot Process Water Softener*

In hot process water softening, the clarity of the effluent depends, among other factors, on the rising rate of the water through the unit... the greater the cross-sectional area, the lower the rates ... the lower the rates, the lower the turbidity. This lower turbidity means fewer filter backwashings and the very lowest labor costs.

The Sphericone, a Graver original design, offers a larger cross-sectional area per pound of steel used, and consequently per dollar invested, than the standard cylindrical type of hot process softener.

The expanding settling zone and larger cross-sectional area provide crystal clear effluent at rates, in many cases, up to 20-30% overload. These features, plus the Sphericone's high efficiency in silica reduction by contact with MgO sludge in a deep, dense blanket, make it one of the most important developments in the hot process softening field.

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

216 WEST 14TH STREET, NEW YORK 11, N. Y. Dept. IP-HP

In Canada: The Bird-Archer Co., Ltd., Cobourg, Ontario • In Mexico: Proveedores Tecnicos, S.A., Puebla 259, Mexico 7 D. F.

GW477

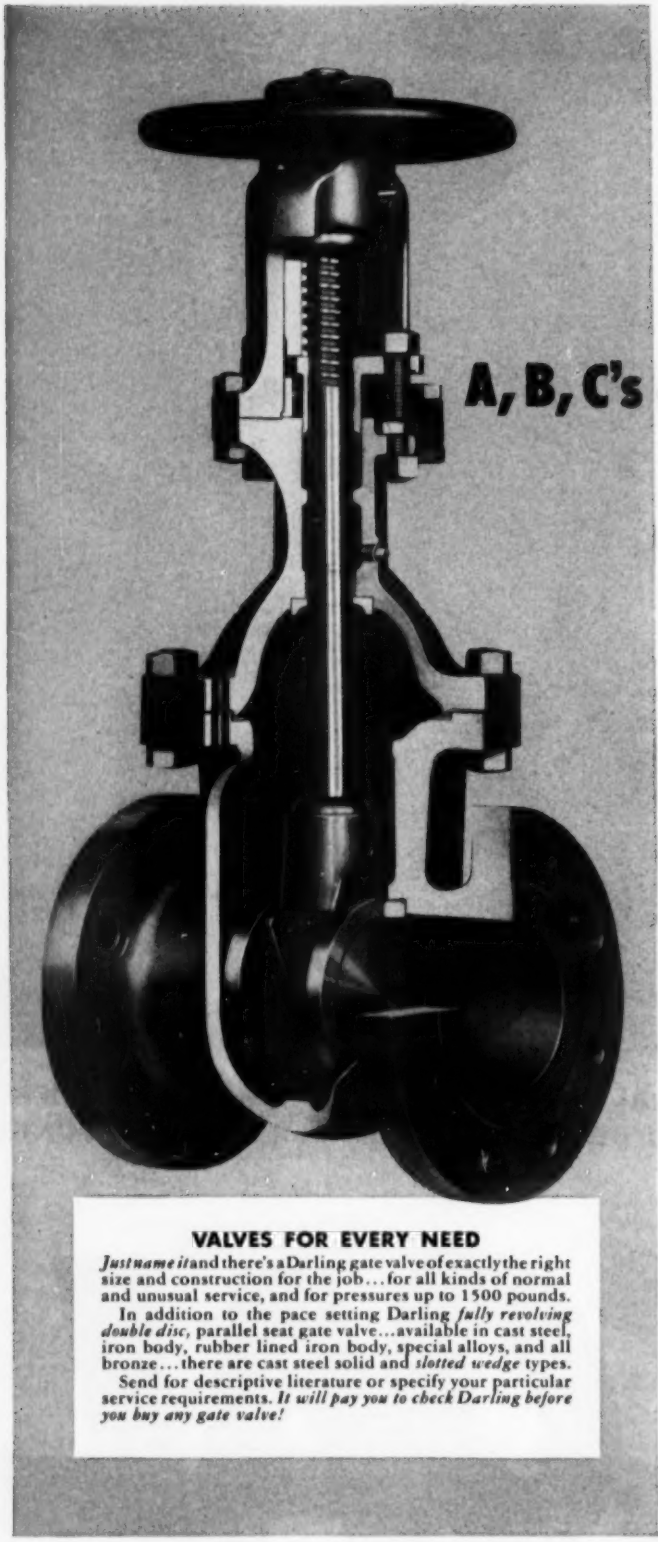
COAL MOVES RAPIDLY FROM FACE TO TIPPLE
IN BEACON'S MODERN MECHANIZED MINES

BEACON COAL

EASTERN GAS AND FUEL ASSOCIATES

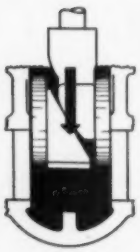
PITTSBURGH • BOSTON • CHICAGO • CLEVELAND • DETROIT • NEW YORK
NORFOLK • PHILADELPHIA • SYRACUSE

For New England: New England Coal & Coke Co., For Export: Castner, Curran & Bullitt Inc.



DARLING VALVES

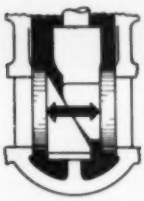
A, B, C's of better valve service with DARLING Revolving Disc GATE VALVES



GATE DESCENDING

A EXTRA LIFE

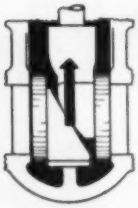
Fully revolving discs, independently hung, change seating position at each closing, assuring uniform wear distribution for prolonged service. Plain "no pocket" discs are interchangeable for *extra* life!



GATE CLOSED

B POSITIVE CLOSING

Faces of the upper wedge are radiused and faces of both wedges are transversely beveled for equalized wedging pressures and tight closing despite valve body distortion.



GATE RISING

C EASIER OPERATION

Wedging pressure on both discs is released before discs start to rise. Complete absence of wedging pressure during travel of discs assures easy operation and greatly prolonged valve life!

VALVES FOR EVERY NEED

Just name it and there's a Darling gate valve of exactly the right size and construction for the job... for all kinds of normal and unusual service, and for pressures up to 1500 pounds.

In addition to the pace setting Darling *fully revolving double disc*, parallel seat gate valve... available in cast steel, iron body, rubber lined iron body, special alloys, and all bronze... there are cast steel solid and *slotted wedge* types.

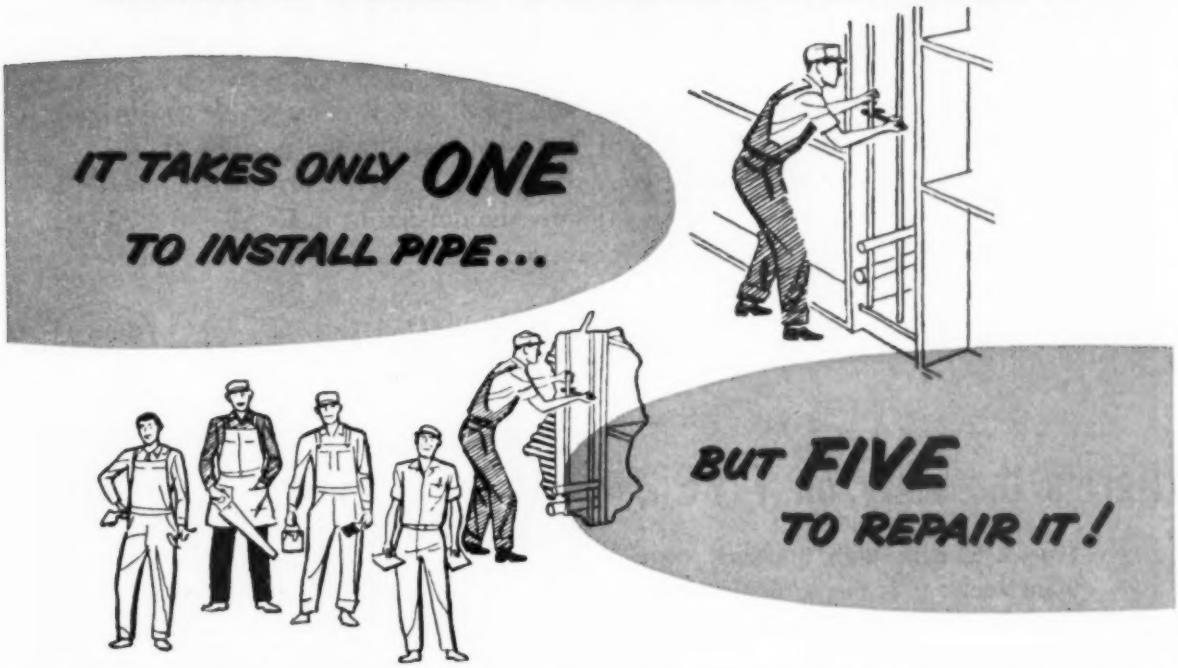
Send for descriptive literature or specify your particular service requirements. *It will pay you to check Darling before you buy any gate valve!*

DARLING VALVE & MANUFACTURING CO.

Williamsport 9, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

Here's why CORROSION COSTS YOU MORE than WROUGHT IRON



One of the most convincing demonstrations of the economy of using *durable* material is a pipe repair job where low-first-cost material has failed—and is being replaced.

The original installation had been quickly made by plumbers. But the replacement calls for hours of work by as many as five crafts: plumber, mason, plasterer, carpenter, painter. Often, maintenance is billed at overtime rates. And this is only part of the cost story. Production slow-down, disrupted routine may amount to far more than the maintenance charges.

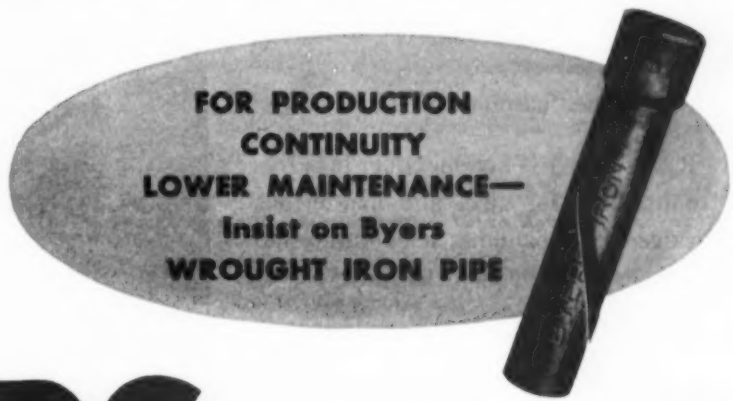
Fortunately there's an answer to pipe durability in corrosive services—Byers Wrought Iron pipe. In literally thousands of applications where corrosion is a threat, the use of this material has proved the soundest kind of economy move.

The next time you specify or approve pipe, you'll find it profitable to investigate the durability records of wrought iron.

Our bulletin, "The ABC's of Wrought Iron," gives the what, why and where of this material. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, New York.

Remember—
the pipe that lasts
the longest
costs the least!



BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

R/M's BIG 7 packing types cover 95% of all packing needs

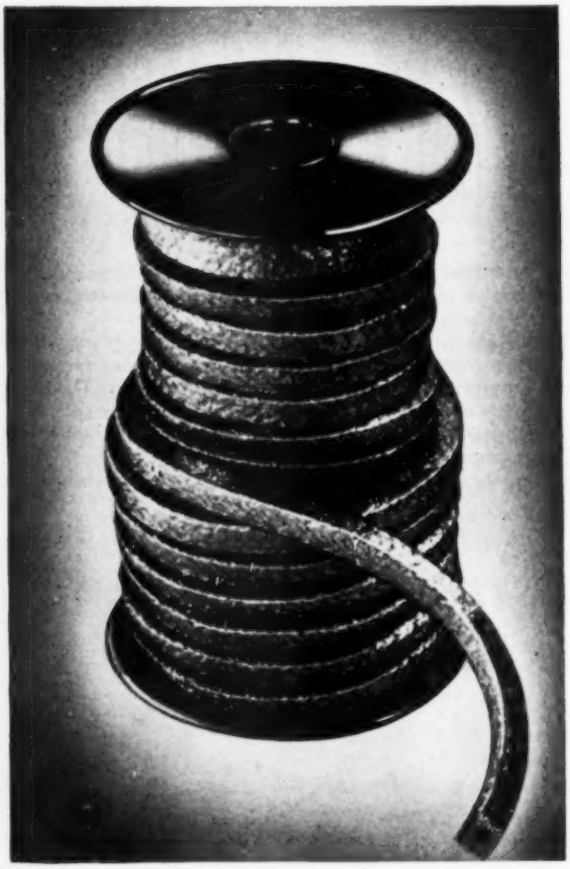
Yes, unless you have extremely rare packing applications, your needs can be met entirely by R/M's new basic line of *just seven* field-tested packing types. Three or four are probably all that you will need to take care of your requirements. Ask your distributor to show you how standardizing on R/M's "Big 7" can lower your inventories, simplify your ordering, reduce your downtime.

Here's the story on TYPE 2

Type 2 Is R/M High Pressure Valve Stem Packing. It comes in two numbers—R/M 303 and R/M 1326-J. Both of these packings have a core of universal plastic packing over which is braided a woven asbestos jacket.

R/M 303 has Monel wire in the jacket. This packing is recommended for valve stems on high pressure and high temperature equipment to 800°F; for pressure equivalents of saturated and superheated steam; for valve stems with Brinell hardness of 400 or better.

R/M 1326-J is non-metallic. It is recommended for steel and non-ferrous valve stems handling temperatures to 800°F. It is excellent for all types of expansion joints.



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PACKING DIVISION, MANHEIM, PA.

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RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Teflon Products Asbestos Textiles • Industrial Rubber Products • Abrasive and Diamond Wheels Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls

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KEYSTONES are complete in every detail—need only to be connected to services. Keystones are compact, 2-drum *water tube* boilers designed for high capacity operations in a wide range of operating pressures. They are conservatively rated (5 square feet of heating surface per developed h.p.)

They feature cyclonic center firing with oil or gas or both. Gases travel 3 complete lengths of the boiler and gas areas are carefully proportioned to decreasing temperatures providing practically constant velocity and assure *no pockets where unburned gases can accumulate.* All boiler surfaces exposed to heat transfer are completely submerged below water line.

You can install a Keystone indoors or outdoors close to steam application. It's fully automatic and requires only part time operator. Booklet SB-38T is available.

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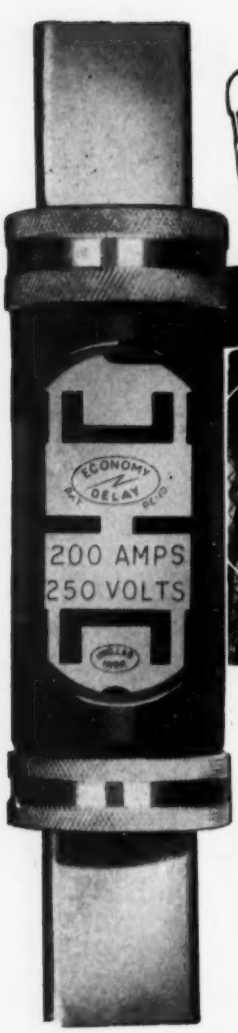

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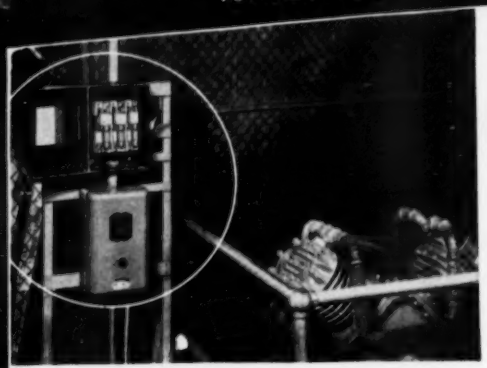

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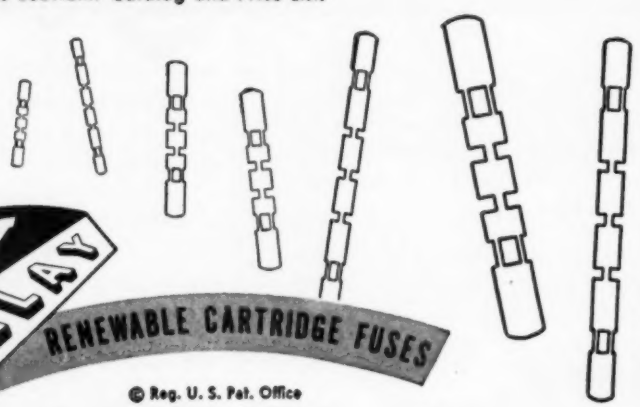
On this air compressor circuit—a typical example of high starting torque—the motor goes on-and-off approximately 120 times in the course of a 10-hour day.

The "ECONOMY DELAY" Fuses shown in this application, operating under these extreme conditions, have blown rarely. If a fuse does blow, all that is required to restore the original fuse efficiency is to insert a new "ECONOMY DELAY" Renewal Link. This requires only a minute or two—which means minimum "down time"... and the cost of an "ECONOMY DELAY" Renewal Link is 3 cents per blow!

The life of an Economy Fuse Cartridge is practically infinite, so, you save money on fuse maintenance and at the same time conserve scarce brass and copper.

Give the extra protection of "ECONOMY DELAY" Fuses to all your circuits. Your wholesaler has "ECONOMY DELAY" Renewable Fuses and Renewal Links in stock.

Ask for the ECONOMY Catalog and Price List.



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Rust-Oleum *cuts costly manhours!* Just scrape and wirebrush to remove rust scale and loose rust . . . then brush Rust-Oleum 769 Damp-Proof Red Primer *directly over the sound rusted surface.* Rust-Oleum finish coatings available in many colors, aluminum, and white give you *double protection.* Sandblasting and other costly preparations are *not* usually required. Specify Rust-Oleum . . . prompt delivery from Industrial Distributor stocks in principal cities.

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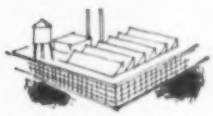
Apply Directly Over Sound Rusted Surfaces—Brush Rust-Oleum 769 Damp-Proof Red Primer *directly* over *sound rusted surface* after scraping and wirebrushing to remove rust scale and loose rust. Sand-blasting, chemical pre-cleaning and other costly preparation methods are *not* usually required.

Available In Many Colors, Aluminum, and White, Brush, Dip, or Spray—Get *double protection.* Beautify as you protect with Rust-Oleum finish coats in the color of your choice.

Practical, Economical Answer To Your Rust Problem—Rust-Oleum resists rain, heat, fumes, sun, salt air, salt spray, and many chemicals—as well as condensation indoors.



Proved Throughout Industry For Over 25 Years—On tanks, girders, pipes, machinery, roofs, buildings, fences, stacks, throughout industry — Rust-Oleum has *proved* its capacity to stop rust for over 25 years.

There is Only One Rust-Oleum

Distinctive as your fingerprint, Rust-Oleum is an *exclusive formula* developed by a Master Mariner during more than 20 years battling actual rust conditions at sea. It incorporates a *specially-processed* fish oil vehicle that will *dry,* is *odor-free,* and is formulated in *many colors.* Be sure you specify genuine Rust-Oleum to assure satisfaction. Accept no substitute.

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Superwashed

COALS ARE BEST

The swing is to Bell & Zoller's *Superwashed* coals! These scientifically-cleaned, correctly-sized coals are top performers in keeping boilers operating at peak efficiency ... steam costs at a minimum. Shipped via rail or economical rail-water routes from the finest fields in Kentucky, West Virginia, Indiana or Illinois.

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NONPAREIL
TRADE MARK
Turbine Oil

Nothing succeeds like service!

● This turbine, one of the largest industrial units in the Midwest, was recently installed by a leading paper mill. The decision of mill officials to lubricate the new turbine with NONPAREIL Turbine Oil was based on their own experience with this outstanding product.

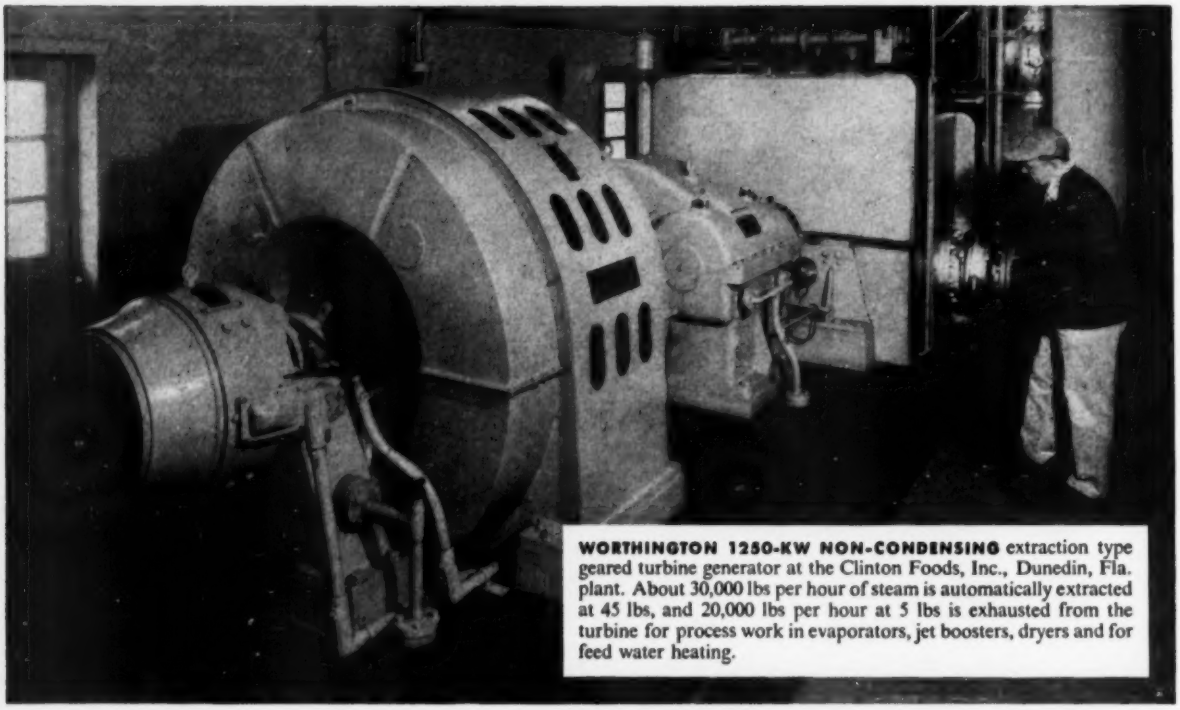
Beginning in 1941 in one unit, NONPAREIL has since been put into additional turbines; and, today, it lubricates all turbines in this big mill. Over the period of 12 years, it has not been necessary to replace any of the original fills of NONPAREIL because of lubricant deterioration or lubrication trouble. Oil systems have stayed clean. Oil acidity has stayed below 0.07 mg. KOH/gm.

In this mill, as in power plants throughout the Midwest, NONPAREIL has sold itself into one turbine after another. That success has been the result of superior turbine lubrication service. Service records of NONPAREIL cover up to 25 years' continuous operation of individual units on original fills of oil. Moreover, this unique lubricant carries a written guarantee that it will last as long as the turbine it lubricates and that its neutralization number will stay below 0.15 mg. KOH/gm.

The Standard Oil lubrication specialist serving your section of the Midwest will be glad to show you lubrication records of NONPAREIL in installations similar to your own. You can contact this specialist by phoning your local Standard Oil office. Or, write: Standard Oil Company (Ind.), 910 S. Michigan Ave., Chicago 80, Illinois.

STANDARD OIL COMPANY

STANDARD *(Indiana)*



WORTHINGTON 1250-KW NON-CONDENSING extraction type geared turbine generator at the Clinton Foods, Inc., Dunedin, Fla. plant. About 30,000 lbs per hour of steam is automatically extracted at 45 lbs, and 20,000 lbs per hour at 5 lbs is exhausted from the turbine for process work in evaporators, jet boosters, dryers and for feed water heating.

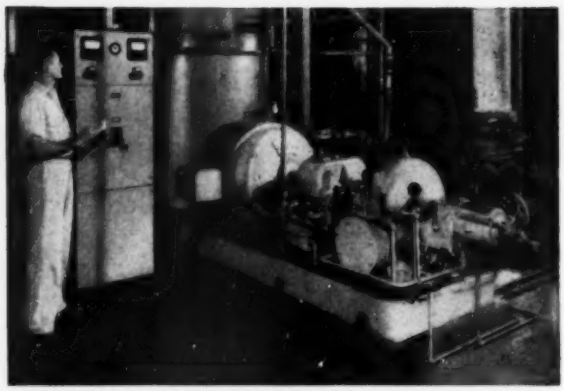
Process steam generates low-cost electricity at Florida orange juice plant

Turbine-generator installation pays for itself in three years

Clinton Foods decided to put some of their process steam to work generating electricity for their plant in Dunedin, Fla. After investigating many kinds of power equipment, plant engineers decided on a 1250 kw Worthington geared turbine-generator set.

After 3 years, the Worthington unit has completely returned its investment in added production and reduced electrical power costs.

So successful was the operation of this unit that Clinton Foods installed another Worthington machine at their by-products mill in their main plant at Auburndale, Fla. This is a 250-kw non-condensing turbine-driven induction generator. Here again, dependable power is supplied in addition to controlled pressure steam taken from the turbine exhaust. This Worthington unit paid for itself in one season. A 7500-kw unit is now being built for the Clinton plant in Clinton, Iowa.



WORTHINGTON 250-KW TURBINE DRIVEN induction generator at Clinton Foods, Inc., plant, Auburndale, Fla. Unit acts as a kw producing-reducing valve and has paid for itself after one season's operation.

By installing Worthington turbine generators, Clinton Foods were assured of low cost power and steam. They were also assured of the undivided responsibility that goes with turbine generators designed, assembled and tested as *complete Worthington units* before shipment.

Sizes to 11,500 kw. For more information, write your nearest Worthington district office, or Worthington Corporation, Steam Turbine Division, Section T.3.1, Wellsville, New York.

T.3.1

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbine Generators

new WIDER VISION

for easier remote boiler water level readings

■ Vastly improved visibility of remote boiler water level readings can now be enjoyed by boiler plant operators.

A new "wide vision" face on Yarway Remote Liquid Level Indicators allows reading from the side as well as front of the indicator. Boiler water levels and other liquid levels can be checked from most any position.

Indicating mechanism is operated by the boiler water level itself—assuring instant, accurate readings.

Yarway Indicators are of the manometric type with automatic temperature compensation, as approved for use under the recent A.S.M.E. Boiler Code Committee ruling in Case #1155.

Over 10,000 are used throughout industry for boiler water and other liquid level indication . . . and for superheater pressure differential indication aboard ship.

For full information write for Bulletin WG-1823.

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BRANCH OFFICES IN PRINCIPAL CITIES

A COMPLETE YARWAY SYSTEM

Besides Remote Liquid Level Indicators, Yarway also offers Liquid Level Recorders and Remote Signal Alarms . . . making a complete system for constant, accurate liquid level check.

■ Yarway Hi-Lo-Graph Recorder provides not only water level indication, but also a 24-hour recording of water levels. See Yarway Bulletin WG-1830.

■ Yarway Remote Hi-Lo-Alarm Signals—lights or horns—can be placed at any location in plant. See Yarway Bulletin WG-1823.

YARWAY® | *remote liquid level indicators*

IT FLOATS ON THE LOAD! *

You turn on the steam.

This little stainless steel valve—the only moving part in the Yarway Impulse Steam Trap installed on the equipment—opens wide and *stays* open as the air and condensate continuously pour through.

The equipment reaches production temperature in the quickest possible time.

Production temperature reached, the little valve snaps shut. After that, by a pulsating action, it discharges all condensate as it forms—even a tiny teaspoonful. *There's hot steam in the equipment all the time* . . . steady, maximum temperatures are maintained.

It all adds up—to more production per day.

Other profit-making features of the Yarway Impulse Steam Trap—low initial cost, easy installation, stainless steel construction, low maintenance, good for all pressures, quick delivery from over 200 local industrial distributors.

Try a Yarway—free for 60 days—and *prove* its advantage. Your distributor will supply you.

For free Yarway Impulse Steam Trap Bulletin T-1740, write . . .

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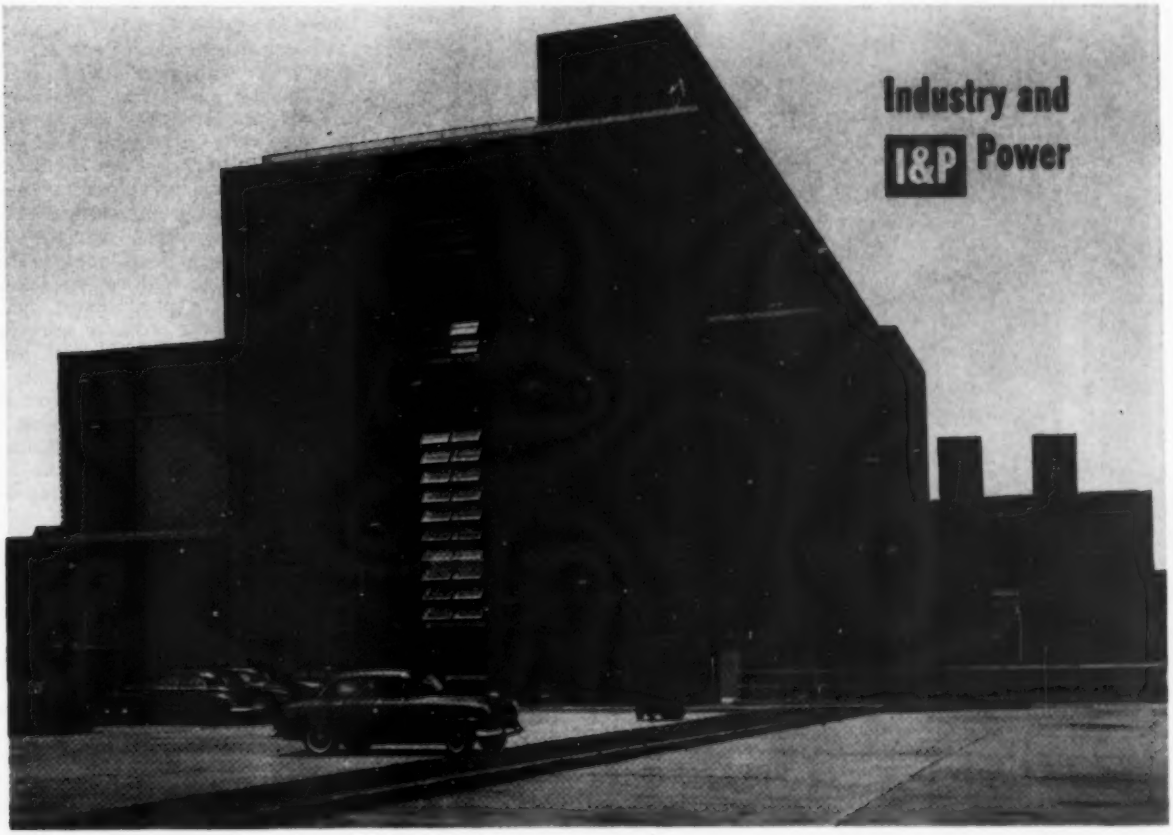
* . . . *resulting in fast heat-up of equipment, more production per day.*

YARWAY | ***impulse steam trap***



Boiler plant exterior is designed to conform with adjacent buildings. Walls extend above roof to conceal the stub stacks.

Fuel Flexibility Plus Clear Stacks

At Boiler Plant of World's Largest Clinical Center

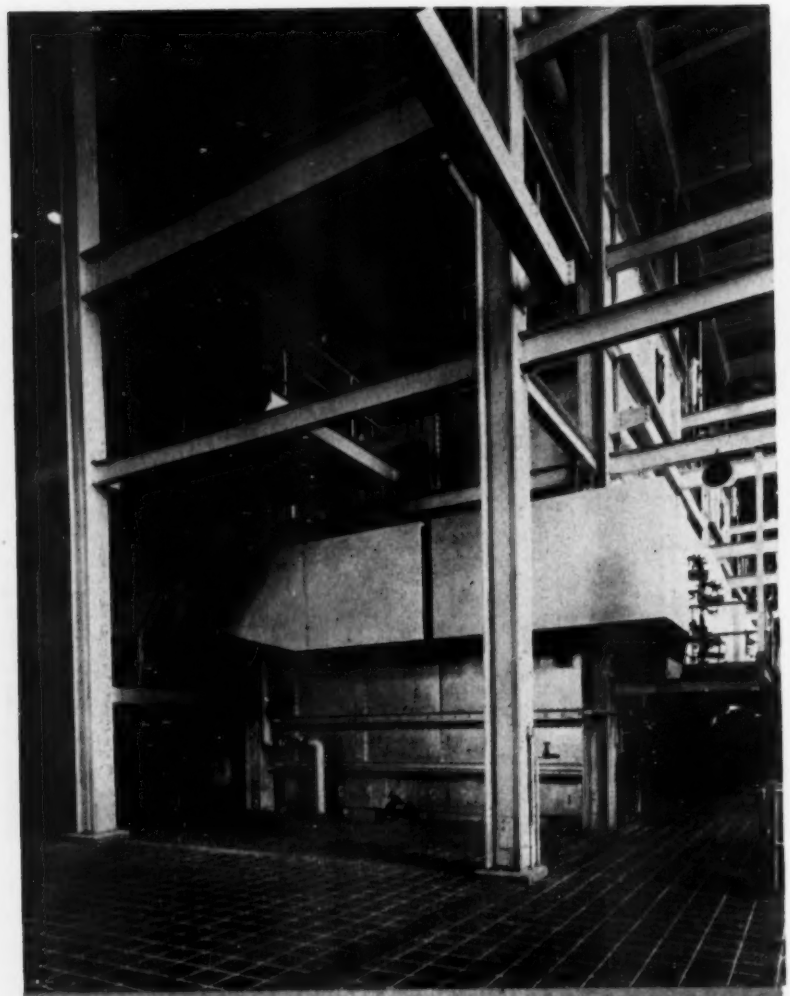
New installation at National Institutes of Health is an example of modern design and layout in buildings, boilers, auxiliaries, and instrumentation.

WILLIAM S. MAJOR, ***Project Engineer***
Machinery Division, Dravo Corporation

THE CLINICAL CENTER of The National Institutes of Health at Bethesda, Maryland is the largest institution of its kind in the world. This research arm of the U. S. Public Health Service is composed of seven institutes dealing with cancer, heart, mental health, arthritis, neurology, dentistry, and microbiology. The Center includes a 14-story, 500-bed research hospital and a number of other smaller buildings for auxiliary laboratory and administration services.

Heating, steam, and hot water services for all buildings are supplied from a central boiler plant through an underground distribution system. When designing this service building, every effort was made to have the architecture conform with the surrounding buildings and to conceal features that would identify it as a boiler plant. For instance, the stub stacks are masked from view by building walls which extend above the roof. Furthermore, conservatively designed boiler furnaces, which discharge their combustion products through dust collectors before going to the atmosphere, minimize smoke and dust emission.

Three, 150,000 lb per hr boilers with independent forced and induced draft systems are now installed and space is available for a fourth unit. A



Three boilers are now installed. Space in foreground is for a fourth boiler.

Plant is arranged for the future addition of electrical dust precipitators.

sectional, side view of one of these steam generators is shown in Fig. 1. Each unit consists of a three-drum, bent tube boiler with water cooled furnace and tubular air heater. The boilers are designed for operation at 165 psig pressure with an entering feedwater temperature of 220 F. A variety of oils or coals can be utilized, with selection depending on which fuel is economically available. For the immediate future it is planned to fire only oil through four burners in the front wall. The plant design, however, provides the necessary space for installing pulverizers and coal handling equipment when economics and/or questionable supply of oil indicates the advisability of switching to coal firing. Table 1 shows predicted performance of these generators for three steaming loads when burning oil.

Feedwater System

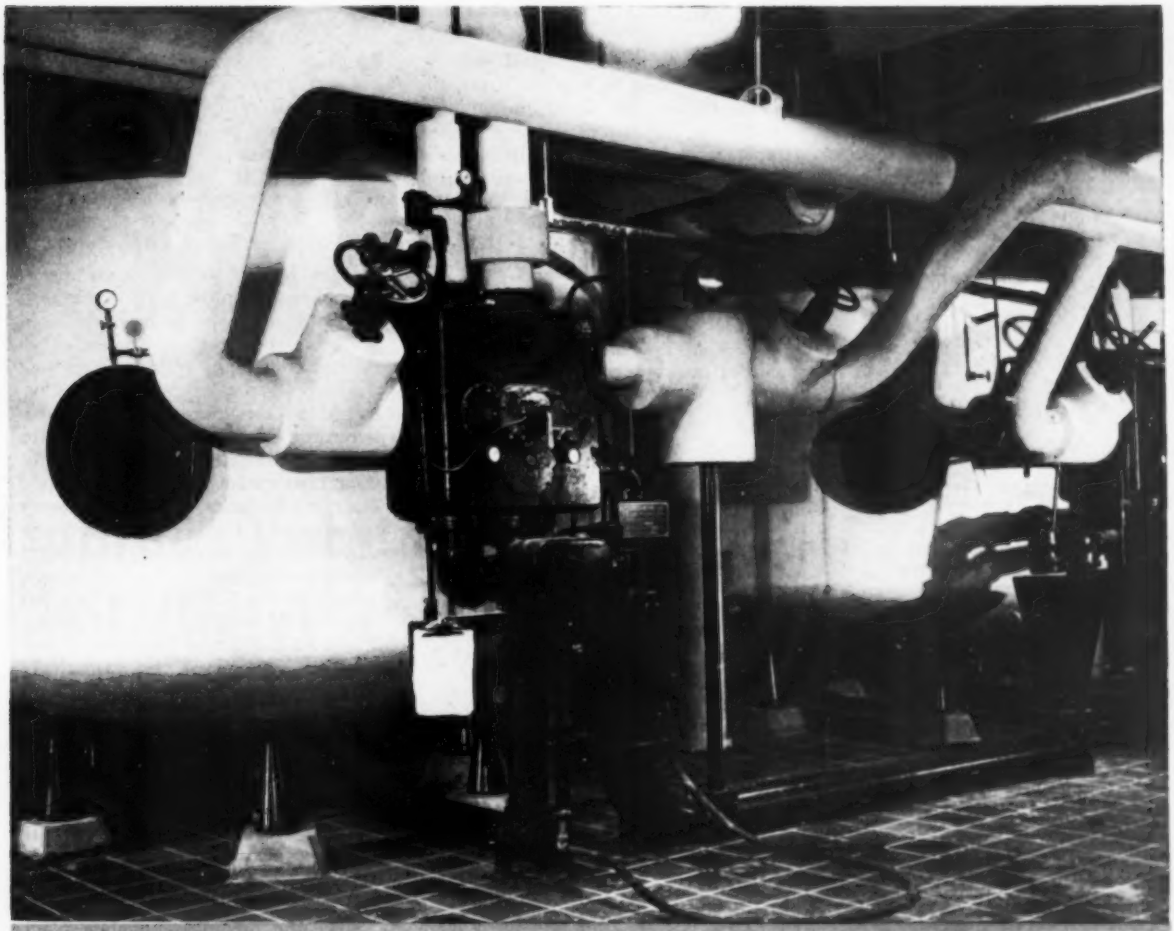
Under normal operating conditions, the boiler feedwater will be a mixture of about 10 percent treated makeup water and 90 percent condensate returns. Equipment, however, is designed to handle up to 50 percent treated water if for any reason the normal expected condensate is not returned from the steam heating distribution system.

The softening system is of the pressure type, consisting of two softeners, each capable of removing not less than 500,000 grains of hardness between regenerations at a flow rate from zero to 400 gpm. All operations including backwashing, brining, and rinsing are fully automatic. After complete regeneration, the softening run is initiated automatically. By means of electrical cross control, each unit is regenerated independently, with the other unit always remaining in softening operation.

Deaerating, spray type heaters are used for boiler feedwater heating. Each heater has adequate capacity to deaerate and heat a mixture of 150,000 lb per hr of softened water at 35 F and 150,000 pounds of condensate at 150 F to a final temperature of 220 F when supplied with steam at 1 to 5 psig pressure. Oxygen in the water leaving the heater, between one-tenth and full load rating, is maintained at not over 0.005 cc per liter.

A continuous blowoff system is installed on the boilers to permit operation of any or all of the units at a maximum concentration of 1700 ppm. The heat exchanger in this system is capable of cooling 12,000 lb per hr of flash drains in the shell when passing 450,000 lb per hr of 140 F water through the tubes.

Combustion controls for all units are of the metering type whereby



Two pressure type softeners are used for treating the makeup water. All softening system operations are fully automatic.

proper fuel feeds and air flows for all loads are adjusted automatically by interconnected and co-ordinated devices between the fuel feed and air flow controllers. The system is designed to maintain: (a) steam pressure within plus or minus one percent of the value for which the control is set, (b) furnace draft within plus or minus 0.01 in. wg, and (c) rates of fuel feed and air flow to the furnace so that the CO_2 in the last boiler pass does not vary over plus or minus one percent of the control setting. The panel board contains a manual adjustment for altering the fuel-air ratio that is to be automatically maintained.

Selector control also is available on the board so that regulation of the induced draft can be obtained by damper or speed control. The induced draft fan is dual motor and turbine driven, and damper control is used at lower fan outputs when the fan is being driven by the motor. At higher loads, the damper remains open and air volumes are controlled by regulating the turbine speed. All controls are arranged to permit operation of any one boiler at steam outputs either equal to or in proportion to other boilers.

The control system also includes safety devices to provide protection in the event either the forced or induced draft fans should fail. If the forced draft fan stops, the induced draft fan will continue to operate and the fuel supply to the furnace will be reduced or shut off entirely. Should the induced draft fan fail, both the forced draft fan and oil flow to the furnace are shut off automatically.

Instrumentation

Both running and permanent records of boiler performance are readily available since the plant contains extensive instrumentation. The main panel includes indicating and recording instruments to show total plant load, level in the fuel oil day tanks, main steam flow, laundry steam flow, feedwater and steam temperatures, and feedwater and steam pressures. Supporting the main control and instrument panel are three auxiliary panels, each of which serves only one boiler. Each of these has a meter for recording steam flow, air flow, and flue gas temperature plus an integrator for the steam flow. In addition, each auxiliary panel contains a hot water meter to indicate and record the flow of boiler feed and to integrate total flow.

As a further aid to proper firing and combustion, there is a seven-point draft gage for each boiler. These gages indicate: (a) air pressure entering the air heater, (b) air pressure leaving the air heater, (c) furnace draft, (d) draft entering the air heater, (e) draft leaving the air heater, (f) draft at the dust collector inlet, and (g) draft at the induced draft fan inlet. Additional convenience is provided by indicating and recording smoke density instruments, with visual and audible alarms. These units are arranged so

that a red light with bell alarm warns of excessive smoke, and a silent green light designates satisfactory density of stack gases.

Although the present plant does not include coal firing equipment, a mechanical cyclone type of dust collector is installed for each boiler. These collectors are designed to remove not less than 90 percent of the total solids in the combustion gases when burning coal. The dust is removed from the gases before they enter the induced draft fan for discharge to the atmosphere. To assure high collection efficiency at the lighter steam loads that are common to plants with a high percentage of heating load, the collector is equipped with diaphragms and dampers. With this arrangement, smaller gas quantities can be passed through only one-third or two-thirds of the collector area, so that sufficiently high velocities are maintained for maximum efficiency.

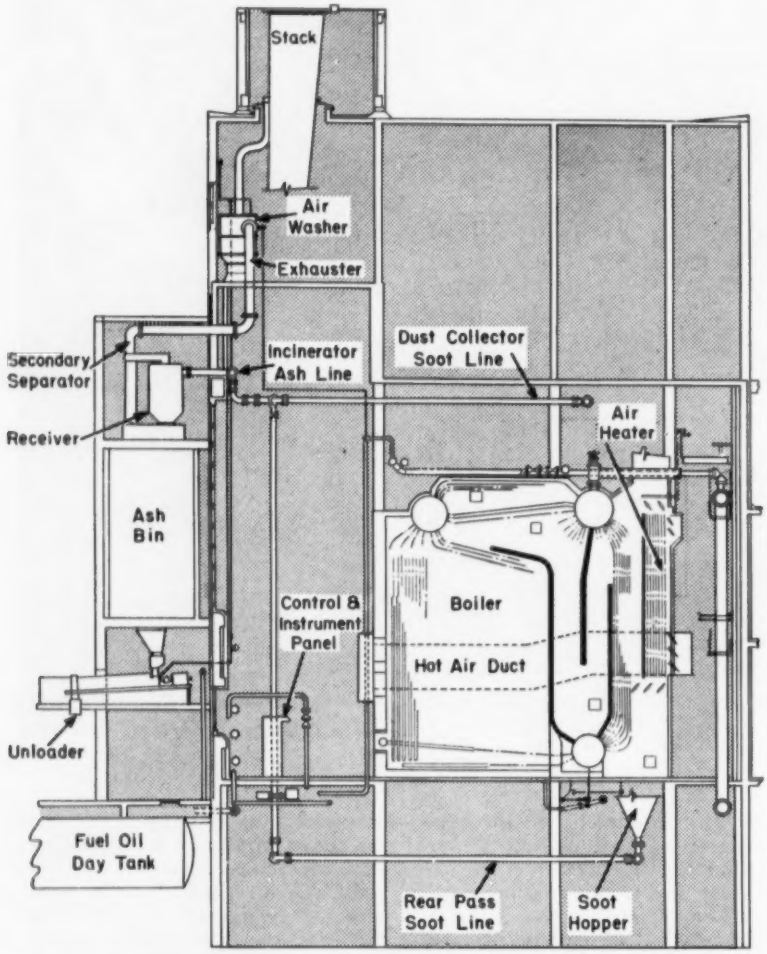


Fig. 1—Drawing shows the arrangement of one of the 150,000 lb per hr boilers.

TABLE 1 — PREDICTED PERFORMANCE OF STEAM GENERATORS

Steam output, lb per hr	75,000	112,000	150,000
Combustion efficiency, percent	80.9	80.5	80.0
Gas temperature leaving boiler, deg F	482	538	585
Gas temperature leaving air heater, deg F	331	363	388
CO_2 in gases leaving boiler, percent	11.5	12.25	12.75
Oil burned, gph	620	933	1254
Combustion air volume, cfm at 80 F	16,800	24,700	33,800
Gas volume leaving air heater, cfm	33,100	48,500	64,300

Provisions for Future Precipitator

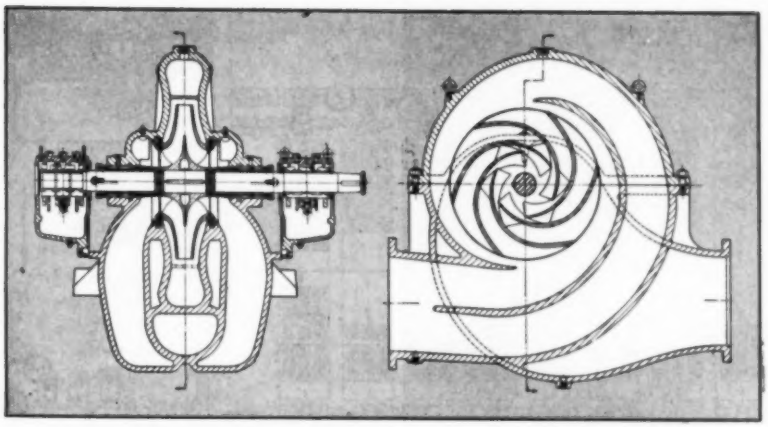
As a further step to assure lowest possible solids in the stack gages when coal is burned, the plant is designed to permit the future installation of an electrical dust precipitator. This unit would be located in the space now occupied by the long duct section between the existing mechanical collector and induced draft fan, which has sufficient capacity to satisfy the increased draft requirements. With this series arrangement of dust collectors, overall efficiencies of 98 to 99 percent would be expected.

Each of the induced draft fans has both turbine and motor drives. A turbine with a reduction gear unit is coupled to one end of the fan shaft through an integral over-running clutch. With this design, the fan may be driven by the electric motor on the opposite end without idling the gear and turbine. The motor drive has sufficient power for operating the boiler at steam ratings up to approximately 90,000 lb per hr.

Ash and Soot Handling

Since the premises contain a plant vacuum system and an incinerator adjacent to the boiler plant, ash and soot handling equipment are installed. This conveying system is designed to handle 12 tons of ash and soot per hour. It is of the pneumatic suction type, steam operated, and designed so that the steam does not come in contact with the conveyed material. Collected material is deposited into an overhead tile storage tank for ready transfer to trucks through a dustless unloader. This motor driven unloader is equipped with water sprays which thoroughly wet the ash and eliminate the possibility of a dust nuisance when transporting refuse away from the plant.

All phases of basic engineering relating to heat demands, types and sizes of equipment, plant design, and architectural features were developed by the engineering staff of the General Service Administration of the Public Building Service in Washington. From these studies, plans and specifications were issued for construction of the boiler plant under public bidding. The Dravo Corporation was the subcontractor responsible for the engineering construction of the boilers and auxiliary mechanical equipment.



Drawing shows internal construction of a double volute centrifugal pump. Fluids leaving the impeller collect in two equal volutes, the tongues of which are located 180 degrees apart.

Double Volute Centrifugal Pumps

Modern single stage pumps provide large capacities because, in the double volute design, the hydraulic forces produced by the fluids in opposing volutes are counterbalanced to minimize radial thrust.

SIDNEY P. MASON
Assistant Chief Engineer
Pump Division
De Laval Steam Turbine Co.

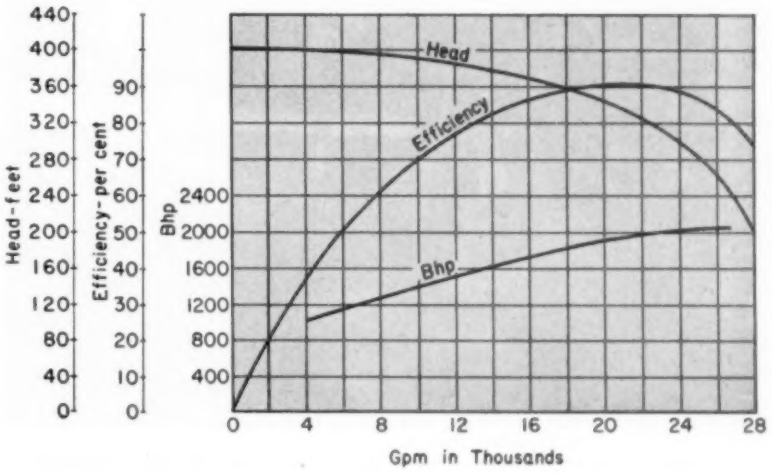
THE TREND in present day centrifugal pump practice is towards the use of higher heads in single stage pumps. Twenty years ago, 250 feet in one stage was considered the maximum head advisable for medium or large sized pumps. A unit required to pump against higher heads would be designed with two, double suction pumps connected in series. With modern high head pumps, it is possible to do the same work in one pump casing.

In a conventional single volute centrifugal pump, the hydraulic forces produced by the fluid in the pump volute act radially on the periphery of the impeller. When the pump is operating at its best efficiency point, these forces are practically equal all around the impeller. At other points of operation the forces become unequal and a radial thrust develops which is exerted upon the impeller.

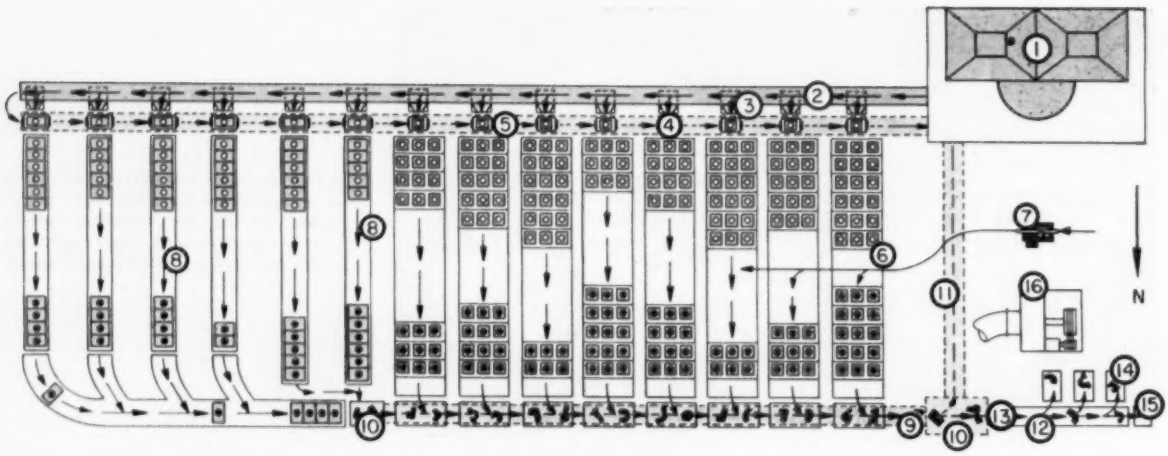
This radial thrust increases in magnitude as the pump is operated closer to the shutoff point where the maximum unbalance occurs. The magnitude of the radial thrust is a function of the discharge head, impeller diameter, and impeller width. Thrust magnitude also depends upon the point on the characteristic curve at which the pump is operating.

With pumps operating against heads up to about 200 feet, radial thrust is not too critical. Shafts are made heavy enough to provide adequate thrust resistance. For higher heads, however, it is advisable to take other precautions to minimize the effects of this thrust. This is accomplished by the use of double volute pumps.

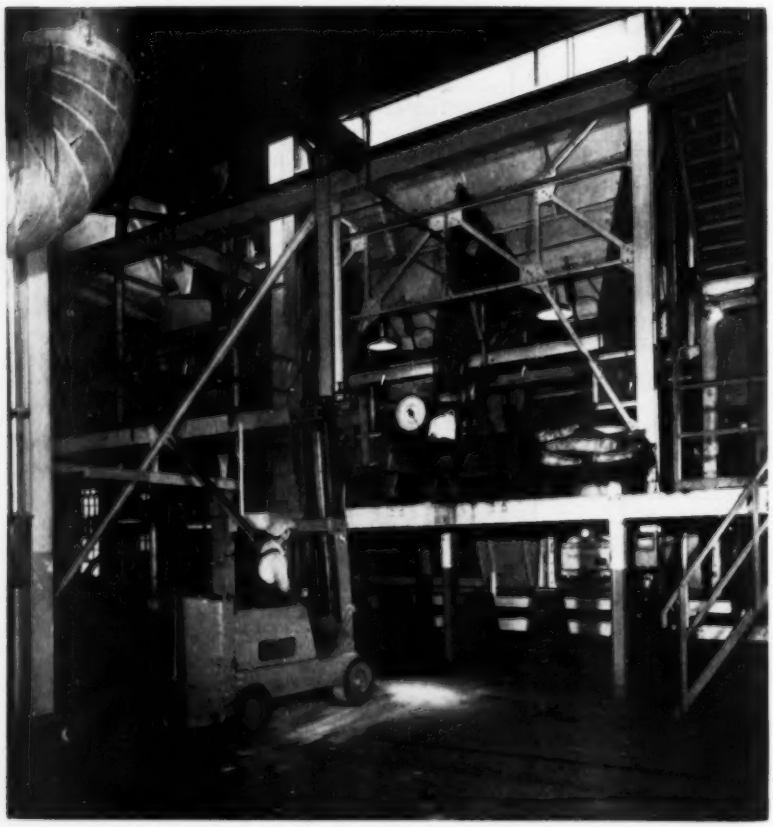
In double volute pumps, the fluid leaving the impeller is collected in two equal volutes, the tongues of which are set 180 deg apart. The two volutes come together in a common outlet to form the discharge of the pump. Hydraulic forces produced by the fluid in one volute are opposed by equal forces produced by the fluid in the other volute. Thus, radial thrust is counterbalanced and for all practical purposes is eliminated.



Characteristic curves shown at right illustrate typical performance of a double volute type centrifugal pump.



Handling Sand and Castings at Dodge Mfg. Co.



The sand center for the entire system, with overhead storage bins and muller.

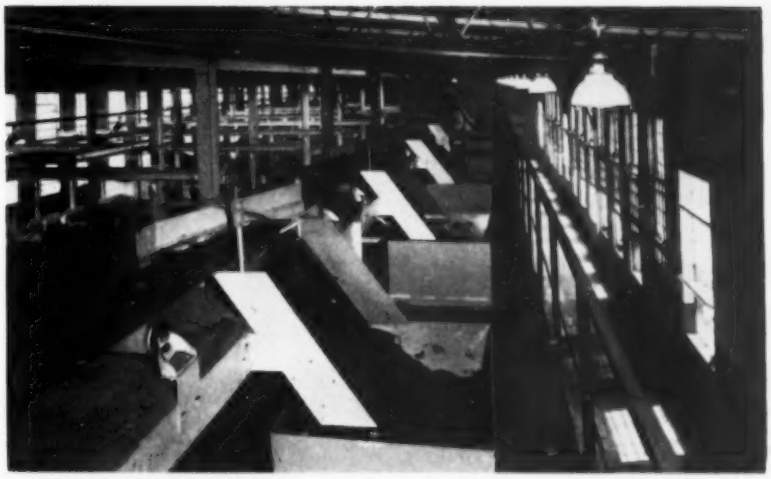
STAFF REPORT

MATERIALS HANDLING in almost any industrial operation requires the use of several different types of equipment. All too often the engineers in charge of the selection of this equipment concentrate on the applicability of each individual unit without giving enough consideration to its integration with the system as a whole. Nowhere else in industry is coordination more vital than in materials handling, for inefficient transfer from one type of handling unit to another destroys the individual efficiencies of both and the overall efficiency of the system.

Dodge Manufacturing Corporation makes equipment for the mechanical transmission of power—products such as pillow blocks, pulleys, V-belt drives, chain and sprocket drives, shaft mounted speed reducers, and various types of clutches and couplings. Their foundry, a part of the main plant in Mishawaka, Indiana, is an excellent example of wise coordination of a variety of materials handling units into one efficient system. It illustrates that such units can be tied together so that the whole

FOUNDRY FLOW CHART

1—Sand Center
2—Fresh Sand Conveyor
3—Sand Hoppers
4—Molding Machines
5—Spilled Sand Conveyor
6—Small Mold Conveyors
7—Molten Iron Ladle
8—Roller Conveyor
9—Oscillating Conveyor
10—Shakeout Tables
11—Sand Return Conveyor
12—Apron Conveyor
13—Castings
14—Casting Boxes
15—Refuse Box
16—Dust Collectors



As fresh, conditioned sand flows along the conveyor above the molding machines, the machine operators turn plows into the line of flow to spill sand into hoppers.

becomes more than the sum of its individual parts.

Two quite different materials, foundry sand—a typical bulk abrasive, and iron castings—heavy, awkward and hot, are involved in the foundry materials handling problem. One interesting aspect of the operation is the contrast in conveyor types required. Sand conveyors must transport this bulk material with as little loss as possible. Casting conveyors, on the other hand, must be designed not only to carry the hot metal parts but to shake loose and drop sand during the transporting process.

Sand Handling

The sand handling system, considered alone, is the simplest of the materials handling problems in the foundry, so far as design and selection of equipment is concerned. Sand is collected in elevated bins or silos. From here it falls into mullers where it is mixed with water, clay, and seacoal to bring it to the proper consistency for use in making molds. The sand is taken from the mullers on a short belt and dropped into a hopper. From this hopper a bucket elevator raises and delivers it to an elevated conveyor belt running the full length of the foundry.

This long conveyor belt supplies sand to 14 hoppers, each located above a molding machine on the foundry floor. Plows are located along the belt to baffle a part of the sand off at each hopper. Since the sand is cool at this stage, the belt is of conventional rubber construction and a service life of approximately 10 years can be expected. Little maintenance is required beyond the regular lubrication of the bearings for the rollers on which the belt runs.

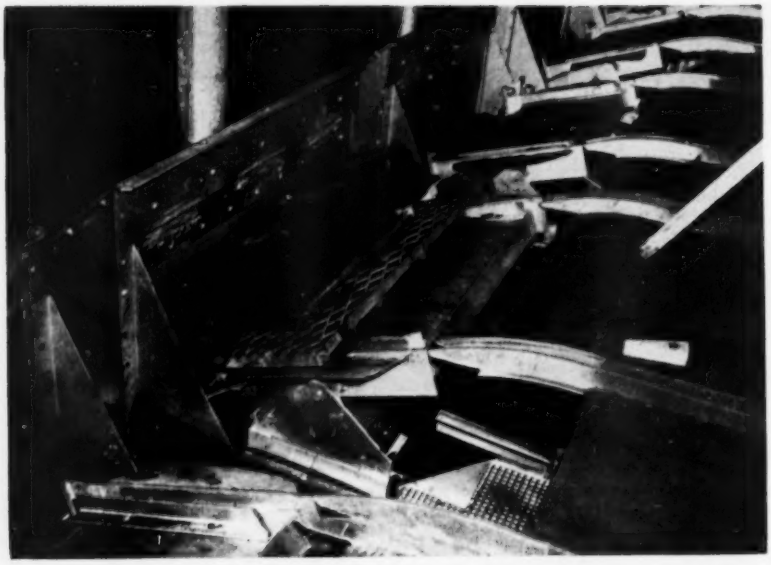
In the molding machines the sand becomes a part of the production process. It is packed into flasks, the patterns are removed, risers are inserted, and the mold is placed on a special conveyor tray which carries it across the pouring area.

Pouring castings from ladle on traveling crane; note metal showing in tops of molds at left is still white hot while the metal in other molds has cooled.

Mold Handling

Handling molds presents a peculiar problem. They must be handled with considerable care until the casting has been poured and has slightly cooled. Then the "kid gloves" are removed. From there on the touch is anything but light, the idea being to knock the sand from around the casting by shear rough handling. In view of this, the mold conveyors must be able to move with reasonable delicacy and at the same time stand up to rough handling and shock upon reaching the end of the run.

Dodge engineers selected for this job a special type of pallet or dolly conveyor made with a platform of expanded catwalk grating framed with steel angles . . . this pallet running on casters, or small roller-skate wheels, guided by angle iron tracks. The pallets are moved across the area manually, each newly loaded pallet pushing those ahead as it is loaded and given a start down the track. Each of these pallets carry three molds. While at rest in the center of the floor, the castings are poured from a ladle of



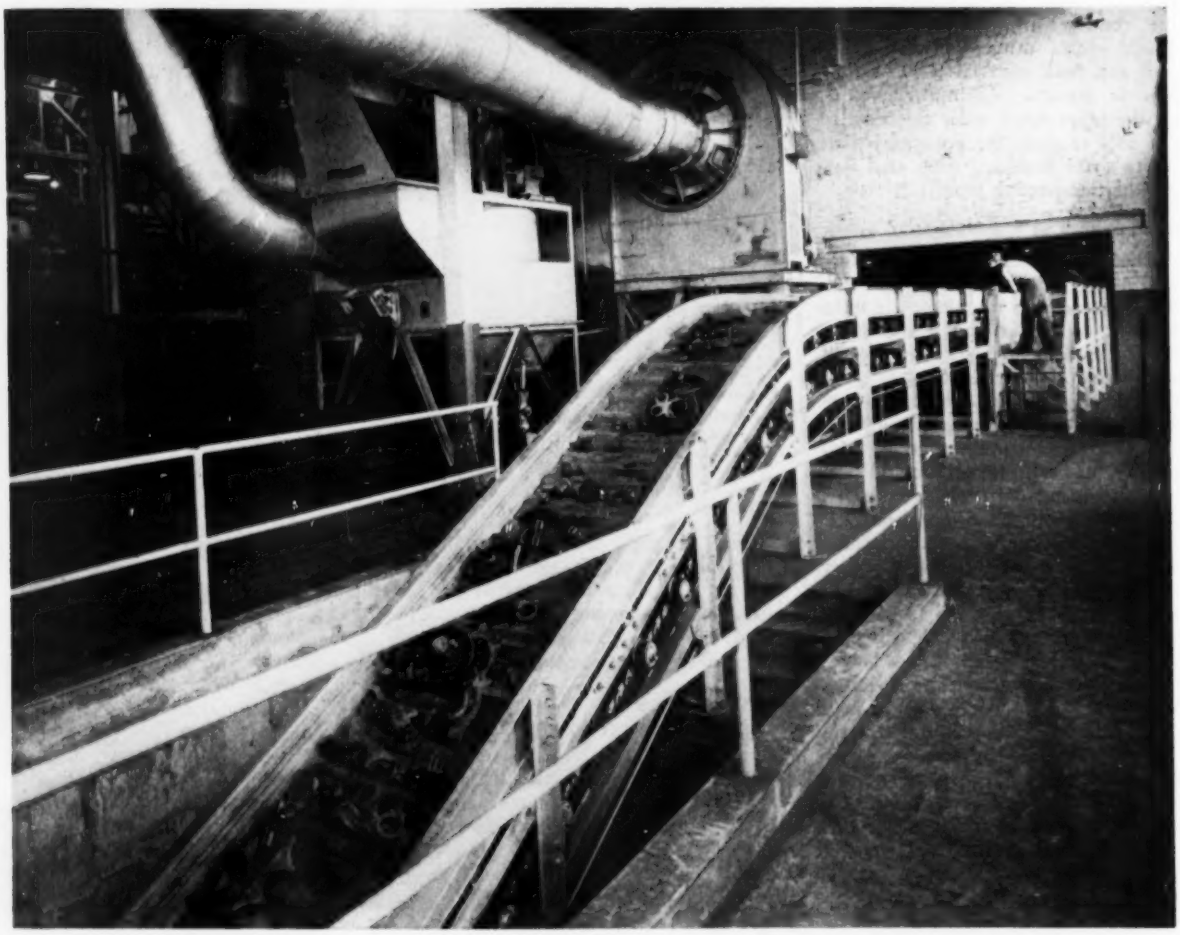
Trays roll down incline and strike open door, throwing molds into chute. Sand and castings fall to vibrating conveyor below the chutes, while empty trays tip back to lower track and return under pouring floor to molding machines.

molten metal swung from an overhead monorail crane.

As the pallets with their molds approach the far side of the area, the metal flasks surrounding the sand are removed. They are allowed to run down a small incline and strike a bumper, the sudden stop throwing the mold and casting into a chute leading downward to an oscillating conveyor. The empty mold pallets roll back by gravity toward the molding machines. For this trip they use tracks located below the pouring floor.

Moving Castings

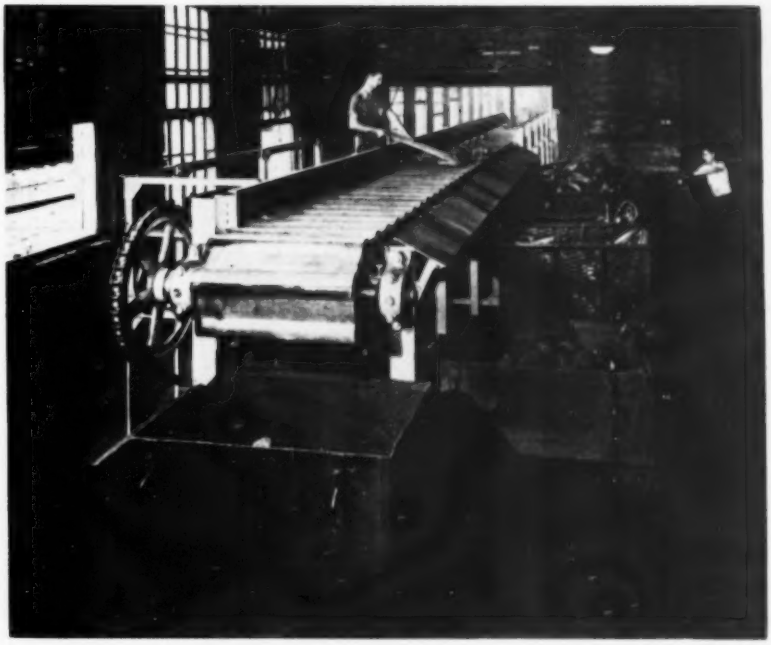
There is about a 6-foot drop from the mold conveyor tray to the vibrating conveyor which runs the length of the foundry in an underground tunnel. The sand around the castings breaks the shock of this fall, but the trays of the vibrating conveyor still take a terrific beating. It is remarkable that they give the service that they do. This Hewitt Robins oscillating conveyor has been in service



Leaving last shakeout table, clean castings are carried by apron conveyor to next room where they are sorted.

Sorting and loading castings (right) directly from conveyor to baskets.

Castings are dumped (below) into Wheelabrator hoist for cleaning.



for over two years. The life of these conveyor pans has been lengthened by welding angle irons longitudinally in an inverted position at 6-in. spacings, so that the falling castings strike on one of these braces rather than hitting flat on the plates as in the original installation.

Sand Returns

As the castings move down this conveyor, the vibration knocks off much of the foundry sand which then falls from the steel conveyor plates onto a rubber belt conveyor running directly beneath. This belt is part of a system which carries the sand back to the sand bins for reconditioning. The sand is hot during this period, and the rubber conveyor belt is of a special construction designed for high temperature handling. It is a 24-in., 4-ply Hewitt Ajax hot material belt with 32-oz duck, 1/8-in. top and 1/32-in. bottom covers; the belt has a floating asbestos insert 1/32-in. above the carcass. A life of approximately 36 months can be expected in this type of service.

The castings, themselves, move from the oscillating conveyor to a short shakeout section where the vibration is extreme enough to separate practically all the loose sand from the cast pieces. From this shakeout, the castings fall onto a steel plate apron conveyor which takes them up an incline to main floor level and then horizontally to the sorting room.

As the castings move along the apron conveyor in the sorting room, an operator pushes them off into specially designed tilting baskets made of expanded metal. This is a sorting process, the castings being dropped off the conveyor into the baskets according to casting size and type. These expanded metal baskets serve excellently for hot castings because they are rigid and yet permit a free flow of air to allow quick cooling. Flat bed electric low lift trucks pick up the baskets of castings and deliver them to a skip hoist which lifts them into a Wheelabrator for cleaning.

Treating Castings

The cool cleaned castings from the Wheelabrator are moved in wooden tote boxes on flat bed electric trucks to the heat treating ovens. Here they are dumped into special high nickel-chrome alloy steel baskets built to stand the high temperature in the oven. This heat treating furnace is of Dodge's own design, and except for the burner section was built by Dodge engineers and construction men. The oven is arranged so that the baskets of castings move through on a roller conveyor. An automatic lift and ram arrangement positions a basket at the entrance and rams it into the burner section. The ram has a stroke which moves each basket fully into the oven door, pushing the other baskets already in the oven forward the length of the ram stroke. The feed is set so that a new basket of castings enters every 12 minutes.

At the oven exit, each emerging basket is moved sideways on a small wheeled carrier which lines it up with a roller conveyor, providing temporary storage. A locating section in this conveyor dumps the baskets of castings into tote boxes after they are cool. These boxes are then moved on electric trucks to the machining and finishing departments of the plant.

The wide variety of handling equipment required for the Dodge foundry took careful planning and serious engineering calculation to provide a smooth material flow. Here in one relatively small area are long conveyor belts, monorails, overhead traveling cranes, special rolling trays, vibrating conveyors, steel apron conveyors, fork trucks, roller conveyors, and bucket elevators—all working together to provide a controlled movement of materials in either continuous or batch flow.

One hundred pounds of good castings require pouring 150 lb of molten metal and handling 600 lb of sand and molds. Adding to this the facts that the sand is handled three times and that manpower is becoming increasingly expensive, it becomes apparent that the mechanization of foundry operations is imperative. The installation at Dodge proves the advantages of mechanization, particularly mechanizaton that integrates adjacent functions. It would seem that other industries might learn much from this example of modern bulk and piece materials handling.

General Electric

Radioisotopes In Industry

DR. PHILIP MILLER
Laboratory Director
Walter Kidde Nuclear Laboratories, Inc.

Radioactive cobalt emits this glow through a protective layer of water nine feet thick. This mass of highly concentrated radioisotope is twice as powerful as the world's supply of radium. It is in use at the present time at Knolls Atomic Power Laboratory.

FISSION PRODUCTS, by-products of nuclear reactor operation, are currently being used for various purposes in industry, but the amounts involved are negligible compared to the potential supply. Like other by-products in longer established industries and processes, fission products are still a nuisance in the over-all operation of the big, high-powered production reactor. They must be removed periodically from the reactor to permit the chain reaction to continue. Because of their intense radioactivity, they must be handled with great care and stored under heavy shielding after they are removed.

The most striking fact concerning the use of fission products is the tremendous supply that could be made available once the applications are found. The fission products now in storage are equivalent in activity to millions of grams of radium, and there is every reason to believe that they will find large-scale application.

The various fission products differ in their half-lives from less than a second to millions of years. As a result, the rate at which a given isotope emits radiation energy varies tremendously. A material that has a half-life of 1 second has only 0.1 percent of its energy after 10 seconds, while a material with a half-life of 10 years has 96 percent of its energy left six months after coming from the reactor.

Disintegration Rate

The figures in Table 1 show the rate at which fission products disintegrate at any particular time. However, for industrial applications, it is more important to know the total amount of radiation that will be given off over a period of time.

The first three values shown in Table 2 are obtained from the fact that the total fission product energy is equal to about five percent of the energy liberated in the reactor. As indicated in Table 2, about 33 percent of the decay energy is given off in the first 10 seconds, and about 96 percent is given off in the first 6 months. About 2 percent of the energy is available for use in the 10-year period starting at 6 months.

While this is a small fraction of the total, it is a much higher ratio than shown in Table 1, where radiation intensities were compared at various time intervals. This results from the fact that while some of the short-lived isotopes have very high intensities of radiation, they die quickly and do not represent a large percentage of the total decay energy over a given period of time.

Fission Product Cost

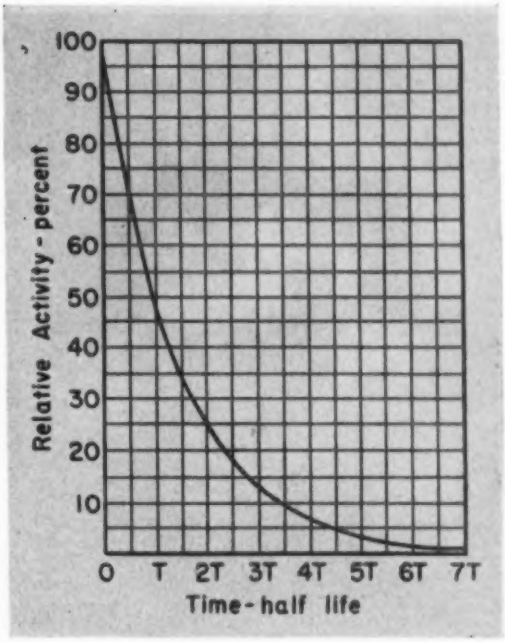
The fission products are collected from the reactor as an aqueous solution or slurry which also contains large amounts of inert chemicals used in the processing operations. At present, this solution or slurry is stored in large underground tanks under heavy earth

shielding, and represents a problem and an expense. To be useful industrially, the fission products would have to be separated and purified to some degree and then be converted into solid form. If the fission products are simply dried with no further treatment, a relatively dilute source of radiation would be obtained, containing anywhere from one to one thousand curies per pound. It has been estimated that the fission products in this form would cost approximately 10 cents to $1 per curie, packaged and delivered.

If the inert chemicals can be removed, the concentration can be increased to an upper limit of 5,000 curies per pound and the price would double. However, in both cases the material would still contain a mixture of all the fission products, with various half-lives and giving off both beta and gamma radiation. For the majority of users, it would be desirable to separate the beta and gamma radiation — particularly where beta is required. It is possible to further refine the fission products and separate them into small groups of isotopes, each giving off one type of radiation. Such materials would cost 50 cents to $50 a curie and would have an intensity up to 10,000 curies per pound.

Finally, it is possible to separate out the individual isotopes at a cost range of $1 to $100 per curie and a strength up to 30,000 curies per pound.

Two of the most interesting isotopes are strontium 90 and cesium 137. These two isotopes are probably the most suitable for fission product applications, although in special cases others might have advantages.



A curve (right) can be drawn representing composite radiation of fission products of reactor. Because radiation decay is exponential, never reaching zero, indication of decay rate is customarily based on time required for radioactivity to subside from a given value to half that value, ie, the time required for the material to reach "half life."

Drug Sterilization

The use of radiation for sterilization is probably the largest current potential market for fission products. When successfully worked out and applied, the demand will probably be in the order of millions of curies. While the process could not compete with heat sterilization, there are important cases of heat sensitive materials that are difficult to sterilize in the conventional manner. Among these are drugs and medical supplies such as the antibiotics, cortisone and blood plasma. At present, such substances are processed and packaged using complex equipment and extreme precautions to maintain aseptic conditions, all of which adds to production costs.

In the case of penicillin, it is estimated that in 1951 the aseptic procedure used increased production costs by $5 million. If cold sterilization by radiation could be carried out at a cost less than this, it obviously would be advantageous.

The process itself would be rather simple. After the penicillin is sealed in small glass vials, the vials would be carried on a conveyor through an enclosed zone in which they would be exposed to a gamma source of the required strength. A plant handling 10,000 pounds a day of vials would require a source of 500,000 curies. The vials would be stacked solidly to form a target 6 or 8 inches deep in order to obtain about 60 percent utilization of the gamma radiation. The conveyor might be arranged to move in a descending spiral around a vertical source with provision for periodically rotating groups of vials so that they all get equal radiation. The whole unit would be surrounded by a heavy concrete shield probably about 4 feet thick.

In spite of its bulk, such an installation would not be very expensive except for the cost of the fission product. At $2 a curie, it would cost about 0.6 cents per vial for sterilization, of which about 40 percent is operating cost. At 20 cents per curie, the cost per vial would be 0.25 cents of which 80 percent would be operating cost. This compares with an estimated cost of 3½ cents per vial for conventional methods.

Studies have indicated that about three million curies could be used initially for the penicillin industry and that it would take two to five years to get the process into commercial use;

TABLE 1

RADIATION INTENSITIES OF FISSION PRODUCTS

Time after shutdown	Watts per gram	Curies per gram*	Curies per year**
10 sec	57,700	31×10^6	279×10^6
6 mo	0.9	488	4.4×10^6
10½ yr	0.055	30.1	0.27×10^6

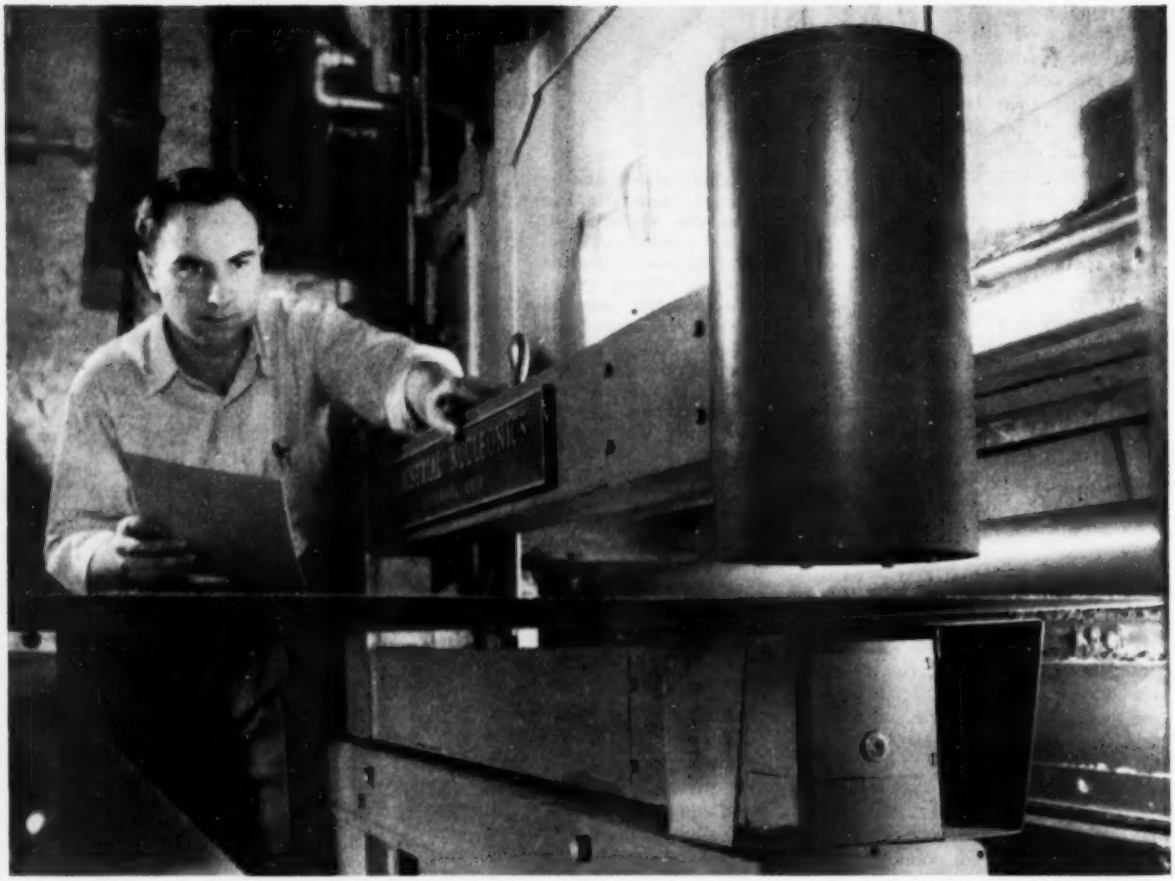
*Based on fission products from one gram of fissioned U-235.

**Based on radiation from one year's output of fission products from the Brookhaven National Laboratory reactor.

TABLE 2

DECAY ENERGY OF FISSION PRODUCTS

Decay period	Energy Watt-Days (per mw-d)	Energy Percent of reactor energy	Energy Percent of total fission product energy
0	50,000	5.0	100
0-10 sec	16,300	1.6	32
0-6 mo	48,000	4.8	96
6 mo-10½ yr	890	0.1	2
10½ yr	1,060	0.1	2



Seiberling Rubber

Radiation from radioactive strontium 90 in end of beam (lower right foreground) is directed upward through rubber sheeting to detector in cylinder. From radiation detected, weight of sheeting and thickness can be easily monitored.

considerable research must be done to determine whether the sterilization can be carried out without any undesirable side reactions. Also, while it is simple to design a sterilization installation for a new plant, it is difficult to introduce one into an existing plant without greatly increasing the cost.

Food Processing

Cold sterilization would be applicable to food for those types that have their taste harmed by heating. This is particularly true of processed meat such as canned hams. At present, canned hams are heated but they still must be kept under refrigeration and the product is not considered very satisfactory. Studies indicate that the canned ham industry could afford to pay 10 to 20 cents per curie for a fission product sterilization and could utilize millions of curies.

Vegetables would supply a much greater market for fission products but they would have to be available at low prices, in the range of 1 to 20 cents per curie. Another big difficulty in the field of food sterilization is the seasonal nature of the operation; the radiation source would be utilized only a fraction of the year. This means that its price would have to be that much lower to make the process economical. The question of undesirable side reactions is even more important for foods than for drugs.

Polymerization

As is generally known, when fission product radiation is absorbed in a material, it causes some of the molecules to be broken into ions or free radicals, making it possible for new compounds to form. However, this effect can be used in a practical way only when a relatively large amount of product can be formed from relatively few free radicals. In other words, the radiation must be used to trigger a chain reaction.

One chain-type reaction in which radiation might be useful is halogenation. At present, ultraviolet light is used commercially to speed up some halogenation reactions which go very slowly in the dark. It is possible that fission product radiation might turn out to be cheaper or more effective for this purpose. Another class of reactions which seem to involve chain reactions are oxidations. Consequently, research on the application of radiation to this type of reaction is also being carried out. Probably the type of reaction that offers the greatest potential use of radiation is polymerization. The hope is that radiation might make it possible to produce polymers that cannot be obtained by other methods.

It is not feasible to estimate how much of a demand there may be for fission products in this field of chemical reactions because at present it is all in the research stage.

Phosphor Activation

Applications of fission products in this category are characterized by the direct use of the ions resulting from fission product irradiation. Radium,

an alpha ray emitter, is now being used commercially for phosphor activation on watch dials and so on. However, beta emitters should be much cheaper than alpha emitters for this purpose. They could be used more extensively in traffic markers, advertising signs, and so on. The radiation will have to be adequately shielded, but a layer of transparent plastic would accomplish this in the case of a material like strontium.

Another direct application of the ionization phenomena is in gaseous discharge tubes such as ordinary fluorescent lights. By incorporating a beta source, some of the gas can be kept permanently ionized. This lowers the starting voltage and also speeds up the starting time of the light. Another application which also depends on gas ionization is static eliminators; another place where static causes trouble is in very fine grinding. At present, various additives are used as grinding aids, adding considerably to the cost.

Another application of fission products is promoting flame propagation. By incorporating an emitter in a combustion zone, such as the cylinder of an internal combustion engine, ignition may be improved and knocking minimized. It might also be very beneficial in jet engines. Many radiation emitters are already in commercial use, using radium or pure isotopes produced in reactors. The question is whether the substitution of fission products would lower the cost and increase the market.

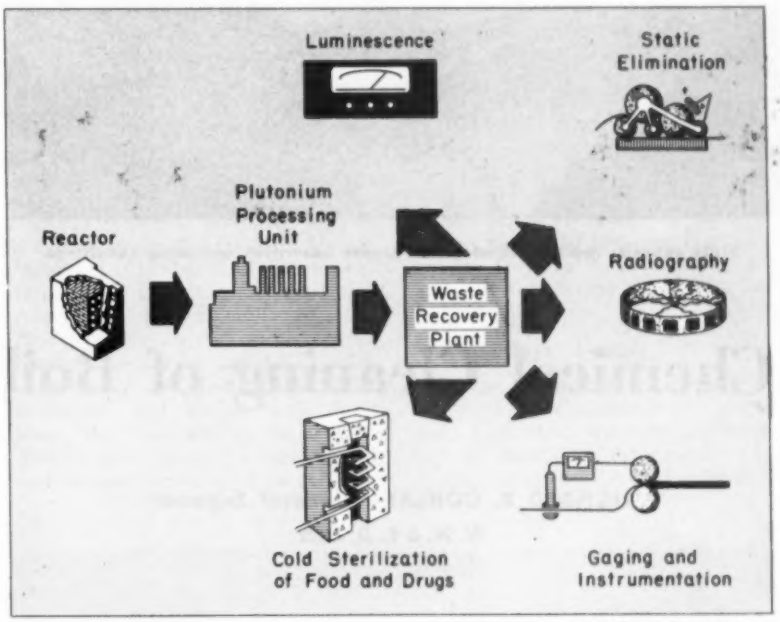
Radiography and Gaging

This group of applications makes use of the penetrating power of radiation. Some simple applications already in use are thickness gages. The gages continuously measure the strength of radiation which penetrates a sheet of material, instantaneously determining the thickness.

Probably the most important application of this type is radiography. Beside the possibility that fission products might be cheaper than radium or X-ray machines for this purpose, they offer another advantage. It is desirable to have a small concentrated source for this work. In a radioisotope like cobalt 60 which has been prepared by reactor irradiation, only part of the material becomes radioactive. On the other hand, fission products like cesium 137 are completely radioactive due to their origin and can, therefore, be prepared in more concentrated form.

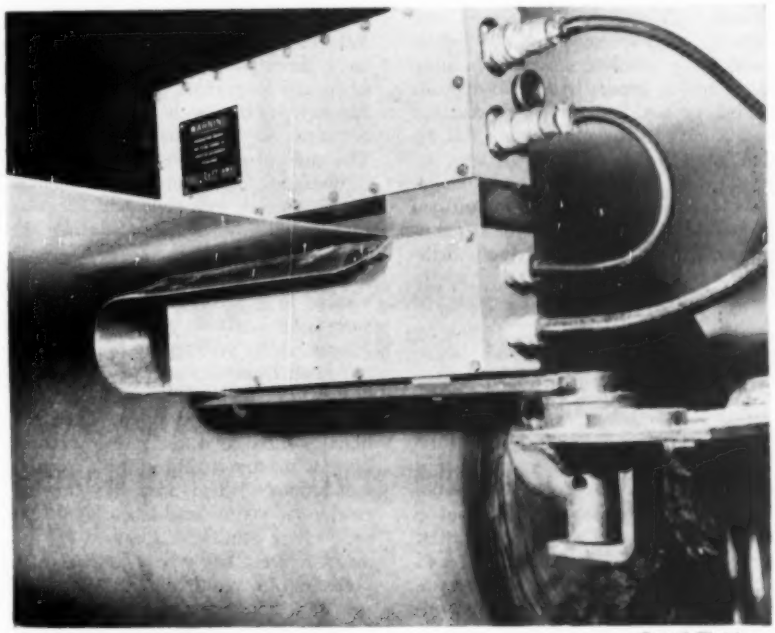
This in turn opens up another possibility which might greatly expand the usefulness of radiography: the development of a direct reading radiograph. Since a film collects the radiation over a period of time while a direct reading instrument is practically instantaneous, it would take a much more concentrated source for the direct instrument. There should be a large demand from industry for direct reading instruments using concentrated radioactive isotopes.

It seems more than likely that there is a big future in industry for radioisotopes, and it may turn out that the most important applications will be entirely different from those that look promising at this time.



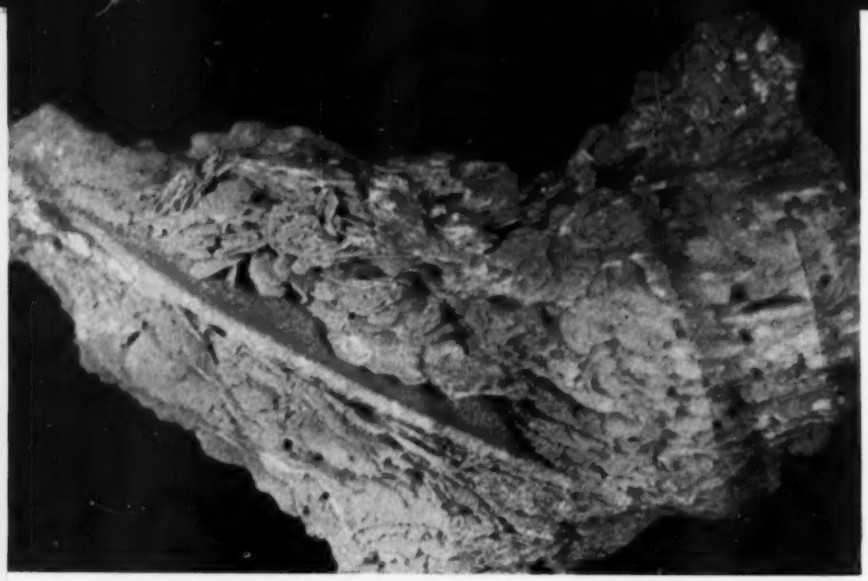
Atomic Energy Commission

This flow chart summarizes the origination of fission products and shows some of the many industrial processes which use these radioactive isotopes.



General Electric

Another application of radioactive thickness gage makes use of this device on paper machine where paperboard flows through gauge continuously.



Scale deposits impair efficiency and create hazardous operating conditions.

Chemical cleaning can be used to remove

Chemical Cleaning of Boilers

RICHARD B. CONLAN, *Chemical Engineer*
W. H. & L. D. Betz

ONE OF THE MOST serious problems encountered in steam generating plants is the formation of scale and sludge deposits or the presence of oil on boiler heating surfaces. In high pressure stations, boiler deposits containing metallic copper and copper oxide have resulted in tube failures. New boilers generally contain deposits of oil, grease, and protective coatings in addition to the mill scale. All deposits on boiler heating surfaces, regardless of their source, should be removed, and this may be accomplished by one of the available chemical methods or by a combination of these methods. The particular method or methods required will depend upon the nature of the deposit.

Alkaline Boil-Out

An alkaline boil-out is used for removal of oil and grease. In new boilers, an alkaline boil-out also will remove the soluble protective coatings and any dirt that may have accumulated during erection. The boil-out is formulated to provide the greatest possible detergent, emulsifying, and dispersive action both on the greases and oils normally found in new boilers as well as the oil deposited in existing units by contaminated feedwater.

While it is not possible to obtain maximum emulsifying and dispersive action by the use of inorganic chemicals alone, they may be used when a specially prepared boil-out mixture is not available. One of the most satisfactory combinations of inorganic chemicals includes three pounds of caustic soda, three pounds of disodium phosphate and one pound of sodium nitrate for each 1000 pounds of water required to fill the boiler to operating level. The sodium nitrate is included in the combination as a precaution against caustic metal embrittlement because high alkalinity develops during the boiling-out procedure.

Before boiling-out a boiler it is advisable to replace normal high pressure gage glasses with temporary glasses. After adding the boil-out material, all manholes are closed and the boiler is filled to the top of the gage glass with the vents open. Then the boiler is fired at a low rate in accordance with the manufacturer's recommendations. When steam is flowing freely, the vents should be closed, except where otherwise specified by the manufacturer or where superheater protection is required. For the average unit, the pressure is then raised to a minimum of 25 psig and maintained for approximately 48 hours. With high pressure boilers, however, boiling-out usually is conducted at one-half of the operating pressure in order to obtain circulation. In all cases, the manufacturer's directions regarding pressure should be followed.

Approximately every eight hours the boiler should be blown down through the bottom blowoff valve until the water level drops to the center of the gage glass. Where more than one blowoff connection is available, alternate valves should be used. After each blowdown, the boiler should be refilled to the top of the glass. Upon completion of the boil-out the unit should be cooled slowly, drained, and flushed thoroughly with a high pressure hose. If inspection of the unit shows that any scum or oil remains, the boil-out should be repeated.

Acid Cleaning

The technique of boiler scale removal by use of inhibited acid has undergone considerable development during the past few years, and a number of new inhibitors are presently available. This procedure does not require extensive dismantling, and consequently labor costs are held to a minimum. All internal surfaces of the boiler reached by the acid solution are cleaned completely, and the true condition of the metal is revealed.

Acid cleaning also is considered desirable for removing mill scale from new boilers. Mill scale is chiefly black magnetic iron oxide which forms when iron and steel surfaces are heated and cooled during manufacture and fabri-

carryover deposits in superheater tubes.

cation. The deposits it produces may cause a new boiler to run "black water" for some time after being placed in operation. These deposits may accumulate where they will impede circulation and heat transfer. Prior to acid cleaning a new boiler, an alkaline boil-out should be used to remove oil, grease, protective coatings, and any dirt that may have accumulated on the surfaces during erection.

Hydrochloric Acid

Either hydrochloric acid or sulfuric acid may be used for acid cleaning. Hydrochloric acid is most widely applied because of the relatively low cost, availability, and the number of satisfactory inhibitors that may be used. In either case, the usual protective measures, such as the temporary replacement of any brass or bronze parts with steel and steel alloy equipment, should be taken prior to the cleaning operation. The system must be vented to remove acid vapors, and any valves connecting the boiler with the main header should be closed.

The two general methods used in acid cleaning of boilers are the "circulation" method and the "fill and soak" method. In the first method, the cleaning solution is circulated continuously through the unit until tests on the effluent show the action is completed. It is suitable for units with positive liquid flow paths and permits regular observations during the cleaning operation. In the second method, the cleaning solution is permitted to soak in the unit for a prescribed length of time. This procedure is used when positive circulation of the cleaning solution cannot be readily obtained.

In the "circulation" method, the unit is filled to overflow with clean water, at the maximum temperature for the particular inhibitor used. This is circulated until a constant temperature is obtained on the effluent which is returned from the highest point of the unit to a tank equipped with a clean water line, steam line, and drain. Positive circulation is maintained by a corrosion resistant pump with a two hour pumping capacity slightly greater than the cubical content of the boiler.

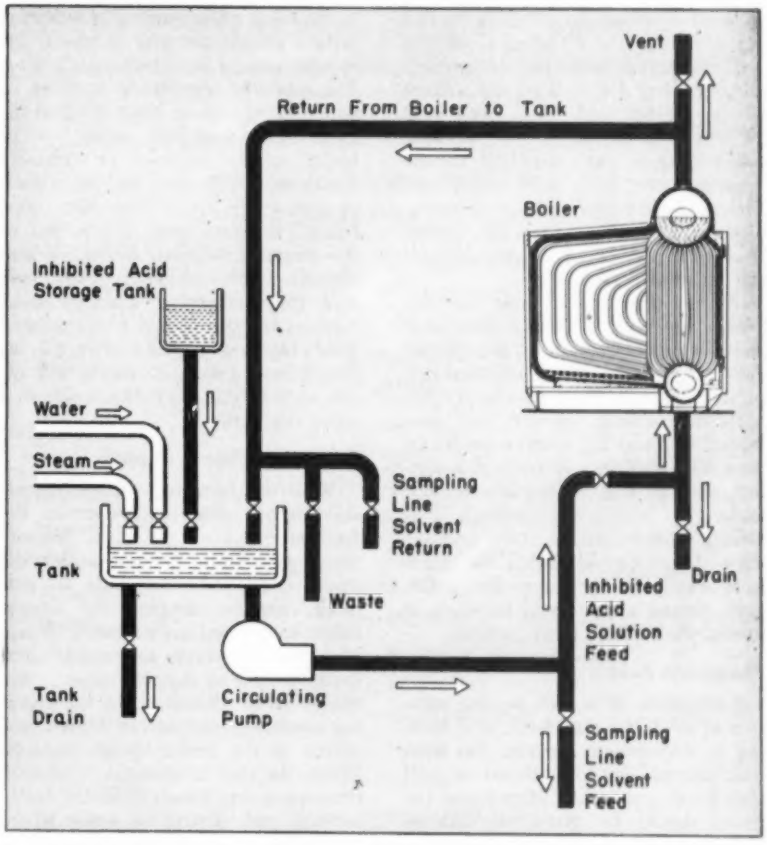
Inhibited acid is added in sufficient quantity to provide a three percent solution entering the unit. This feed is continued until tests on the effluent solvent indicate a maximum acid content has been reached. If continued testing should reveal a one percent drop in acid content of the effluent solvent, sufficient inhibited acid is added to restore the desired acid concentration. Circulation of the solvent through the unit continues until acid content of the effluent is constant, thus indicating the end of the reaction between the solvent and the deposits.

Following acid cleaning, the boiler is drained and flushed with clean warm water until tests on the returned flushing water show it is free of acid and soluble iron salts. A neutralizing solution, generally soda ash, is introduced and circulated until the returned water shows a definite alkaline reaction. To aid in neutralization and to release the hydrogen generated during the cleaning procedure from the metal, the unit can be fired at 50 psig or somewhat higher pressures after circulation of the neutralizing solution has been stopped and the water level has dropped to normal. During this period the unit should be vented occasionally to permit escape of the liberated gases.

At the completion of the neutralization period the unit is drained and flushed with clear warm water. When the boiler is to stand idle for more than a few days before being returned to service, steps should be taken to protect the metal surfaces from corrosion. This can be accomplished by employing either the wet or dry lay-up procedures.

"Fill and Soak" Method

In the "fill and soak" method, inhibited acid is added in the proper ratio with warm water or condensate (at the maximum temperature permitted for the inhibitor) to give a



Schematic diagram shows arrangement for "circulation" method acid cleaning.

CHEMICALS FOR ALKALINE BOIL-OUT AND ACID CLEANING

Chemical name	Formula	Available form	Commercial strength	pH*	Use
Sodium hydroxide**	NaOH	Flake, lump, liquid	74-76% Na_2O	12.9	Alkaline boil-out
Disodium phosphate	Na_2HPO_4	Granular, powdered	48.5% P_2O_5	9.1	Alkaline boil-out
Sodium nitrate	$NaNO_3$	Granular	99.5% $NaNO_3$	6.25	Alkaline boil-out***
Hydrochloric acid	HCl	Solution	27.9% HCl (18°C) 31.5% HCl (20°C)	1.0	Acid cleaning
Sulfuric acid	H_2SO_4	Solution	66° Be-93.2% H_2SO_4 60° Be-77.7% H_2SO_4	0.9	Acid cleaning
Phosphoric acid	H_3PO_4	Solution	75% H_3PO_4	1.8	Acid cleaning

* pH values are for one percent solutions
** Caustic soda
*** Used for embrittlement prevention

cleaning solution of the desired acid strength. The unit is filled to overflow with the vents open. Soaking is carried out for a predetermined length of time, depending upon the type and estimated quantity of deposit as well as the rate of reaction between the deposit and solvent. This information is obtained by laboratory tests.

At frequent intervals samples are drawn from available points and tested for acid strength. While such samples will not reveal conditions throughout the unit, they will indicate the amount of deposit removed. Vent gases must be tested for any hydrogen liberated. Open flame is not permitted in the venting area. With new boilers the soaking period approximates six hours, although treatment may be discontinued after a shorter period, depending on control tests.

At the end of the acid cleaning period the unit is flushed with clear warm water until tests on the effluent show the unit is free of acid and any soluble iron salts. Then the unit is filled with neutralizing solution and permitted to stand for a short period of time. The level then is lowered to normal, and the unit is fired as described under the "circulation" method. Following neutralization the unit is drained and flushed, and if the boiler is to stand idle for more than a few days, proper steps should be taken to protect the surfaces from corrosin.

Phosphoric Acid

Circulation of a five percent solution of inhibited phosphoric acid, boiling at atmospheric pressure, has been used successfully for removal of mill scale from new boilers. Here again, the boiler should be given an alkaline boil-out prior to cleaning. Following cleaning some authorities recommended the use of an acid rinse to remove any iron that may have been deposited on the boiler surfaces during the draining of the acid cleaning solution. One percent solution of phosphoric acid may be used as a rinse. The final step in the cleaning procedure consists of an alkaline treatment for neutralizing the remaining acid and for conditioning the metal surfaces.

Inhibited phosphoric acid possesses certain advantages over inhibited hydrochloric acid for chemical cleaning. The inhibited phosphoric acid can be boiled in the unit by direct firing of the boiler with negligible attack on the boiler metal. Noxious or corrosive fumes do not develop, and the natural circulation resulting from the direct firing promotes good distribution of the cleaning solution. Boiler surfaces cleaned with inhibited phosphoric acid resist corrosion whereas metal surfaces freshly cleaned with inhibited hydrochloric acid react with the atmosphere and some corrosion will occur, especially if the boiler is left in a moist condition.

Removing Copper Deposits

With the increased use of copper and copper alloy equipment in the feedwater systems of high pressure steam generating stations, boiler deposits composed principally of iron oxide, metallic copper, and copper oxide have been encountered. While acid cleaning serves to remove iron oxide, copper or copper oxides in the sludge cause difficulties. In the cleaning operation, copper can replate and adhere to the boiler metal surfaces. When the unit is returned to service, the copper may loosen from the boiler surfaces and deposit in areas where circulation is less rapid. If normal circulation is impaired, overheating may occur and may cause tube failures.

Copper deposits can be removed mechanically, but the process is long and tedious. In recent years a number of boilers have been chemically cleaned to remove copper deposits. The solvents used for such cleaning are ammonia base oxidizing agents. Their effectiveness is based on the reaction of the oxidizing agent with metallic copper to form cupric oxide. This oxide is dissolved in ammoniacal solution to form the familiar cupric-ammonium complex ion. Since these reactions are reversible, it is necessary to maintain certain fundamental conditions during the treatment period. Excess oxidizing agent must be available in the solvent, and the ammonia present must be maintained at a uniformly high level of concentration. The cupric-ammonium ion concentration must be uniform in the solvent.

One of the first solvents used contained sodium chlorate (the oxidizing agent), ammonia, and ammonium sulfate. With this type solvent, the boiler generally is fired intermittently to induce circulation and to obtain temperatures in excess of 175 F which are required to rapidly oxidize and dissolve the copper. If overheating of the boiler develops at localized areas, increased attack on the boiler metal by the oxidizing agent will occur. Also, in overhead areas the ammonia content may be depleted causing copper already taken into the solution to replate on the boiler metal. Thus, any ammonia driven off into the air space in the boiler drums decreases the concentration of the solvent, rendering it less effective.

Another type of solvent containing ammonium persulfate (the oxidizing agent), ammonia, and sodium hydroxide is highly reactive with metallic

copper even at room temperature. This solvent is circulated in the boiler for a short period, and then the unit is drained and flushed with clear water. Although this solvent may be used at room temperature there are disadvantages connected with its use since it reacts as rapidly with iron as it does with copper. Therefore, any accurate chemical control of both oxident consumption and quantity of copper dissolved is difficult.

Copper deposits can be removed successfully with a solvent containing potassium bromate (the principal oxidizing agent), slight amounts of sodium chlorate, ammonia, and ammonium carbonate. This solvent is circulated continuously through the boiler at a temperature of 140 to 160 F. The speed of the reaction between the solvent and copper is such that the use of this solvent permits analytical control during the cleaning action.

Conclusions

Deposits of oil and grease as well as boiler scale, iron oxide, and copper deposits may be removed from the boiler metal surfaces by chemical cleaning. When employing any of the chemical cleaning methods the proper technique must be followed and the necessary precautions taken. With regard to boiler scale, it should be recognized that acid cleaning is not a substitute for proper feedwater treatment.

Although the technique of acid cleaning has progressed to a point where there is little danger from corrosion during the cleaning process, it is advisable that the procedure be carried out under the supervision of experienced personnel. During acid cleaning every safety precaution must be exercised. The ever present danger of hydrogen explosion exists because hydrogen is evolved in the reaction of acid with iron. In pockets where hydrogen mixes with air, any spark or open flame will ignite the mixture. Other gases, such as hydrogen sulfide, also may be generated during the cleaning process, and therefore adequate venting is essential.

Personnel handling any acid as well as most inhibitors should be fitted with proper safety clothing, including protective goggles as well as rubber gloves. Protective masks also are necessary to protect against vapors that produce a suffocating effect and irritate mucous membranes.

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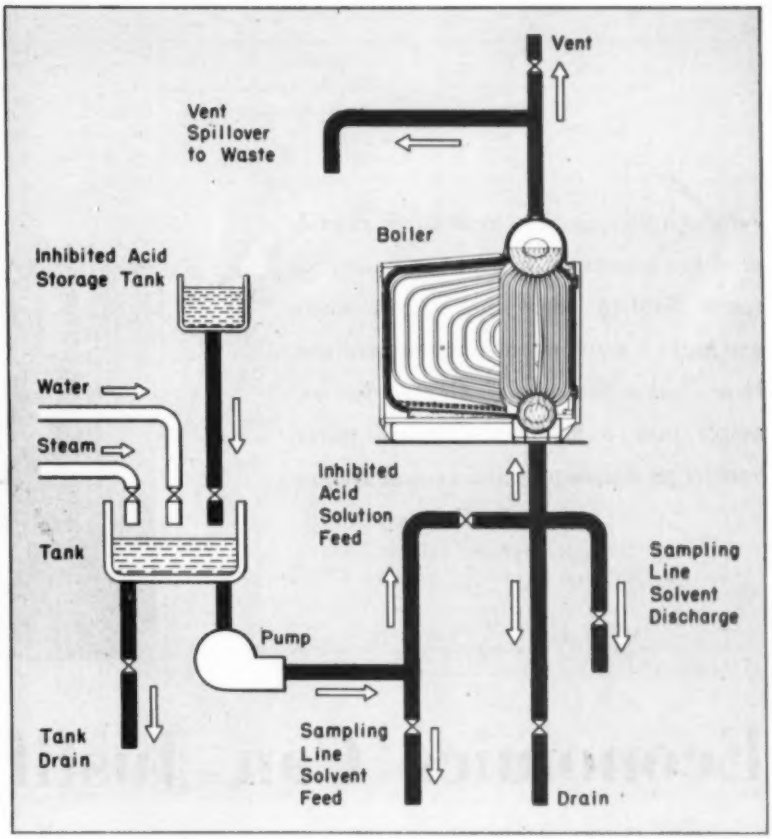


Schematic diagram shows arrangement for "fill and soak" method acid cleaning.

CRYSTALLINE SCALE CONSTITUENTS

Identified by X-Ray Diffraction

Name	*Formula*
Acmite	$Na_2O.Fe_2O_3.4SiO_2$
Analcite	$Na_2O.Al_2O_3.4SiO_2.2H_2O$
Anhydrite	$CaSO_4$
Aragonite	$CaCO_3$
Brucite	$Mg(OH)_2$
Calcite	$CaCO_3$
Cancrinite	$4Na_2O.CaO.4Al_2O_3.2CO_2.9SiO_2.3H_2O$
Hematite	Fe_2O_3
Hydroxyapatite	$Ca_{10}(OH)_2(PO_4)_6$
Magnetite	Fe_3O_4
Noselite	$4Na_2O.3Al_2O_3.6SiO_2.SO_4$
Pectolite	$Na_2O.4CaO.6SiO_2.H_2O$
Quartz	SiO_2
Serpentine	$3MgO.2SiO_2.2H_2O$
Thenardite	Na_2SO_4
Wollastonite	$CaSiO_3$
Xonotlite	$5CaO.5SiO_2.H_2O$

Although electricity is most often considered too expensive as a power source for space heating, there are factors which can make it economical in some situations. New York's Rockefeller Center for example uses a hundred electrical space heaters to supplement the central system.

Economics Can Justify Space Heating With Electricity

MILTON EPSTEIN
General Manager
Industrial Engineering and Equipment Co.

A COMPARATIVE cost analysis of fuels on a Btu basis usually places space heating using electricity among the most expensive. In spite of this there has been an unusual growth in the use of electricity for space heating. This results from the fact that while Btu cost is a consideration, other factors may be of even greater importance.

A primary factor is the markedly lower initial cost of the electric heating equipment compared to fuel-fired devices. A substantial saving is also made in building costs since no floor space is required for electric duct heaters and no stack need be constructed. With these factors considered along with the Btu costs of electric heat, hundreds of installations testify to the economics which justify electric space heating, especially in mild climates.

In the southern part of the country winters are short and not severe. Many electric heating installations are made along with electrical facilities for air conditioning; very little additional cost is involved to accommodate the electrical heating. The heating load is usually larger than the cooling load; by sizing the electric system for the heating load, it can also serve the cooling load.

The cost of the larger capacity electric line to accommodate the heating load is only slightly larger than it would be for the cooling load alone. The labor involved is the same and only a slight additional materials cost is required. Since the cooling and heating loads come on individually, each helps maintain a favorable monthly demand charge throughout the year.

Supplementary heating is often necessary in large installations already served by a central system. Some areas in such systems may be too cold in winter; cases are known where areas served by central air conditioning have been too cool in summer. In both seasons, it is often far more economical to install small auxiliary electric heaters, from 1 to 5 kw, to adjust the systems rather than to revamp a central control system or the central heating and air conditioning system itself. With such local heating, individual control is afforded the area served.

Many other factors arise where central heating is in use, where ordinarily it would be expected that the central plant could economically serve all needs. Typical is a plant where main boilers are shut down during the night and over week-ends and holidays. However, heat may be needed in superintendents' and executive offices during the times the plant is not in operation. Instead of attempting to meet

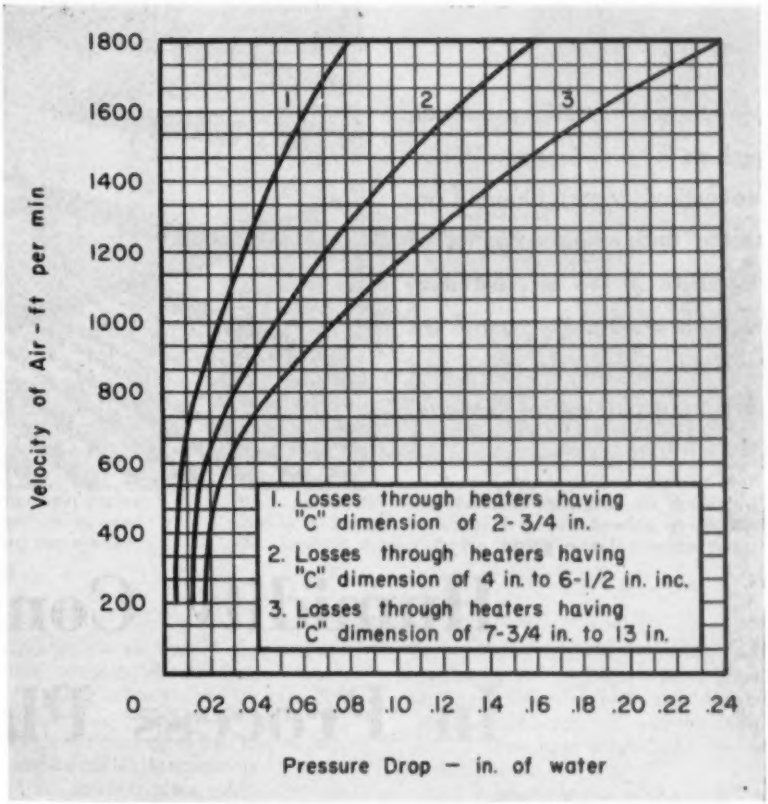
these small heating needs by firing the main boilers, it is found economical to install supplementary electric heating.

Cases exist where offices needing heat are located far from the plant's steam lines. Condensation losses in a line running to these offices would be far greater than the cost of using electric lines already installed to heat the office space.

Full and automatic remote control of heating in distantly located pumping houses is afforded by electric space heating. Such installations, rarely visited by operating personnel except for periodic inspections, are easily operated by using electric heat. Control and "fuel handling" operations are simplified to a high degree.

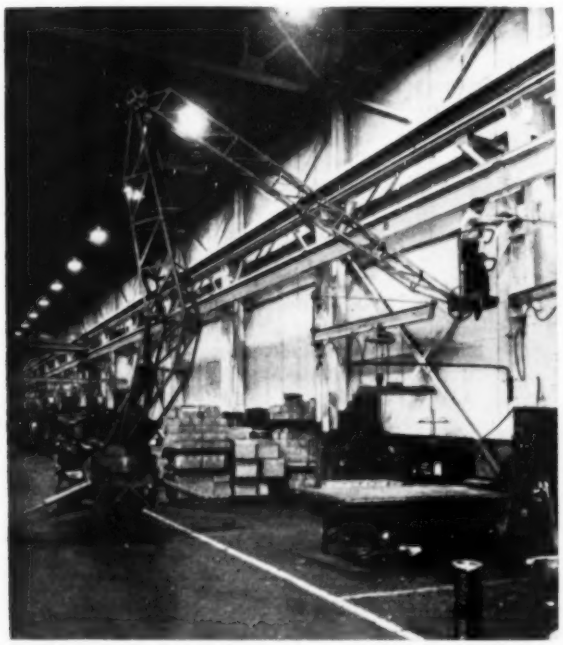
Primary Heating

Perhaps due to the increasing familiarity with electric heating by engineers using it in industrial manufacturing operations, attitudes have changed somewhat regarding electricity as power for space heating. Primary space heating installations using over 8000 kw of electric heating equipment have already been installed in a single industrial plant. Again, many factors contribute to such decisions aside from the Btu costs of fuels. With discretion, it may often be found that such factors do justify space heating with electricity as the source of heat.



Electric space heater loss curves; "C" dimension is heater element thickness.

Mobile Tower Aids High Bay Maintenance



IN MANY PLANTS the task of servicing ceiling-hung fixtures and in-plant equipment includes cleaning and changing lighting, checking overhead heaters, painting, repairs to piping, and changes or installations of service lines. Maintenance work in the St. Clair plant of Euclid Road Machinery Company, Cleveland, presented these problems, complicated by a ceiling height of 40 feet.

D. L. Lawrence, the plant engineer, specified a mobile aerial tower mounted on a Towmotor unit. It consists of a hydraulically operated extensible tower with full control from the operator's platform at the end of the boom.

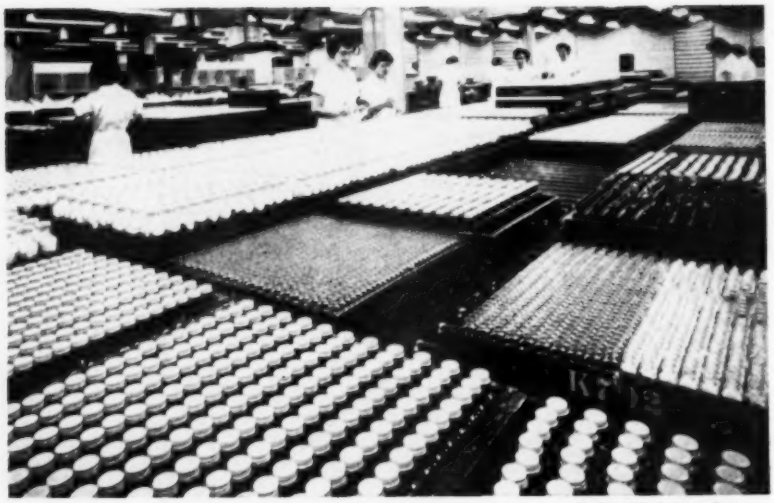
After positioning the unit in a convenient aisle space, the operator steps to the platform and moves the folded boom to working position. Top working position of the platform base is 43 feet above the floor. However, the operator has a working reach of approximately 50 feet. The unit has a maximum horizontal reach of 30 feet.

To operate the tower, a single-lever hydraulic control enables the operator to engage the platform in three movements either simultaneously or individually. He can elevate or drop the upper or lower boom, or swing in a 280-degree arc all at the same time.

A master foot-switch must be depressed to permit any movement. Release of the switch automatically locks the entire circuit, halts all movement, and idles the engine.

Platform is rated at 340-lb load capacity and has been tested safely at 600 lbs in all positions.

Many manufacturing processes, such as the preparation of pharmaceuticals (right), demand accurate and reliable control of moisture in the air. Several methods of humidity control are available to meet the many and varied requirements of this type.



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Humidity Control In Process Plants

HUMIDITY is a factor equal in importance to temperature during any drying process. The moisture content of the material entering a drier should be known, and be kept as low and as uniform as possible. The difference in moisture content between inlet and outlet determines the amount of evaporation of water from the goods to be dried. For hot-air driers, the relative humidity of the air is the decisive factor for the results achieved.

Hot-Air Driers

A general rule for hot-air driers is that the exhaust air should leave the drying plant at the lowest permissible exhaust temperature, but at highest possible relative humidity. However, the majority of hot-air driers lack the means of efficient humidity measurement. For example, although it is obvious in leather drying that humidity has to be controlled, older drier installations seldom have humidity meters installed. The same applies to timber, lacquered goods, foodstuffs, chemicals, and so on. Air temperature often is carefully measured, but humidity is overlooked.

One of the reasons why hygrometers or wet and dry bulb thermometers are absent seems to be their rather high price for higher temperatures. Another reason seems to be that the use of humidity meters for exhaust air has not been sufficiently advocated. The result is sometimes over-humid drying rooms or cabinets, having a stuffy atmosphere which retards the rate of drying a great deal.

Automatic Control

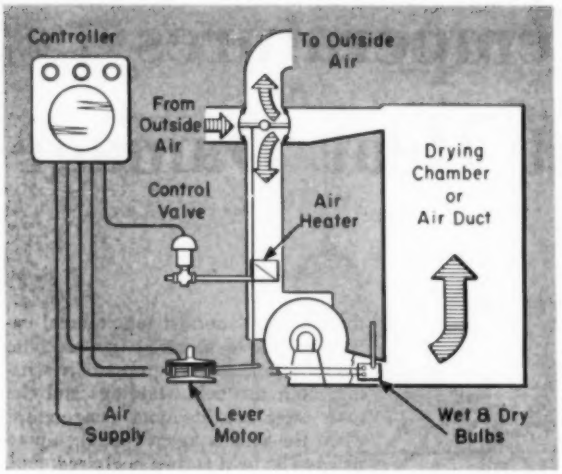
A quality of a drier which helps considerably in automatic control is self-regulation, that is, the quality of a drying plant to adapt itself to small disturbances in the heat load or in the heat supply. The tendency of a drier to restore heat balance more or less by its own effort, without the help of manual or automatic control, is invaluable.

Surface Combustion Corp.

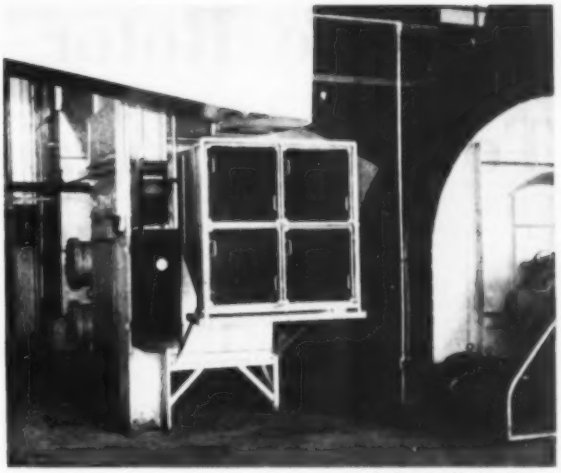
Close control of humidity is critical here where newly formed gelatin capsules are dried by air.

Forced Air Circulation

Forced air circulation units (as with heater batteries or unit heaters with fans) have better self-regulating qualities than driers using natural air convection and heating pipes only. The slow heat distribution in the latter, such as in certain leather drying rooms, introduces heat distribution time lags which aggravate the tendency for temperature over-run. A tunnel drier with trucks exhibits poor controllability due to possible rapid change of heat load. The fan of the heater battery at one moment may be delivering hot air against little resistance; as the loaded trucks are run into the tunnel, resistance to air flow and heat distribution is greatly increased. Even given instant response from a control instrument, the temperature of the inlet air from the heater will rise over the set point due to sudden decrease of air flow rate with unchanged heat supply capacity from the heater battery. Conditions could be improved by applying sequence control to the battery by



This automatic control system for a drying room makes use of wet and dry bulb thermometer readings to send humidity data to the controller regulating the system.



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On a humid day, this chemical absorbent air drier removes 50 barrels of water from air flowing at 70,000 cfm, insuring proper drying during match manufacture.

sectionalizing the battery coil to provide more constant conditions throughout.

Chemical Absorbents

Chemical-absorbent dehumidifying equipment uses a very hygroscopic solution, consisting chiefly of a lithium chloride base. This solution is sprayed into an air washer chamber through which the air passes to be conditioned. Upon contact with the absorbent, the air loses a controlled amount of its moisture.

Control of the degree of dehumidification is determined by the temperature and amount of cooling medium flowing through the cooling coils over which the air and absorbent solution pass. The moisture-absorbing property of the absorbent is inversely proportional to its temperature. The cooler the solution, the more moisture it is capable of absorbing. Cooling media may range from cooling tower water to extremely low temperature refrigerants.

Absorbent Regeneration

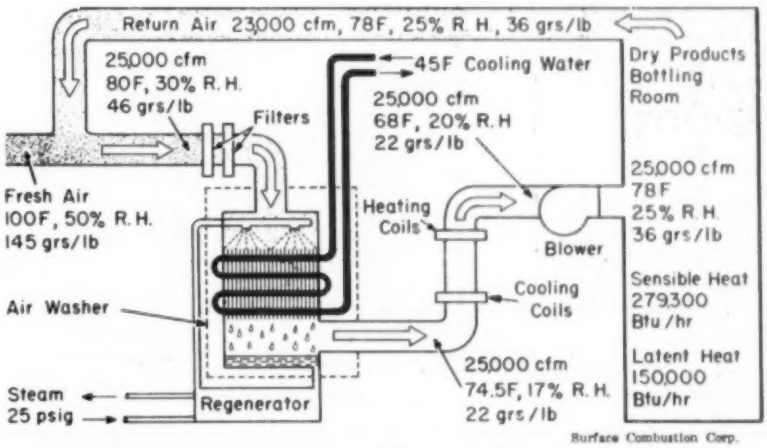
Operation of the equipment is continuous and entirely automatic. Regeneration of the moisture-laden absorbent is accomplished in a separate regenerator chamber, where the solution passes over low-pressure steam coils. Here the excess water in solution is driven off and then exhausted to the atmosphere by a scavenger air stream. The reconditioned solution is then returned to the air washer chamber at full strength, ready for another dehumidifying pass.

Depending upon the temperature and quantity of the cooling medium used in the air washer chamber, a certain amount of air temperature reduction is accomplished directly. Sometimes it is necessary to employ separate after-cooling in this type system to attain final air temperature control.

In another plant, automatic high-speed production of pharmaceutical capsules depends on thorough drying of gelatin shells. During periods of high humidity, production lines become clogged with trays of partially dried capsules.

Installation of automatic, continuous air drying equipment using chemical absorbents proved extremely satisfactory. This same class of equipment has been successfully used in a plant which had the problem of drying matches during the match manufacturing process. Here, the problem was to maintain an artificial climate, since the air could be neither too dry nor too damp. At the same time temperature had to be controlled.

Air conditioning is a necessary element in pharmaceutical plant operations, among others, to obtain maximum production at lowest unit cost and to meet rigid quality specifications. Utilization of a chemical-absorbent system of air conditioning, entailing after-cooling, has met strict around-the-clock pharmaceutical manufacturing requirements with no contamination of the product, low operating and maintenance costs, and a ruggedness in service over a period of years.



Surface Combustion Corp.

System layout of the equipment used to insure proper humidity control in the bottling room where pharmaceuticals in gelatin capsules are packed.

Measure Rotor Temperatures To Guard Against Heat Damage

FRANK E. REEVES
Consulting Engineer

Means should be provided to measure rotor temperatures on all 3600 rpm generators of 10,000 kw or above.

INDICATORS AND RECORDERS are very commonly used for measuring temperatures of stator windings on almost all sizes and types of a-c generators, synchronous motors, and synchronous condensers. There is widespread agreement about the desirability of maintaining a close watch on temperatures of such armatures as a basis for safe loading.

With speeds of rotors up to 1800 rpm, very little trouble was ever experienced with the field windings, and there seemed to be no good reason for an investment in rotor temperature measuring equipment. The introduction of the 2-pole, 60 cps, 3600 rpm generator poses new problems in rotor design because of the extremely high centrifugal forces produced at this speed. The actual occurrence of field failures justifies reconsideration of monitoring warning.

The most common cause of rotor failure is locking of the windings in place by centrifugal forces, preventing the windings' normal longitudinal expansion due to heating. If a machine has had time to cool prior to re-starting, both the field windings and the rotor steel are at room temperature when the unit is again brought up to speed. The field is then energized, and the machine is loaded. The field windings warm up first as a result of the field current. The temperature of the rotor body then rises through the transmission of heat from the windings. Expansion of the field windings (usually copper or aluminum bars) therefore takes place before the expansion of the rotor.

There is obviously a time lag between the expansion of the windings and that of the rotor steel. In addition, the coefficients of thermal expansion for copper and steel, or for aluminum and steel are not identical. The result is a differential expansion.

Rotors are normally designed so that such differential expansion can occur without causing distortion of the wind-

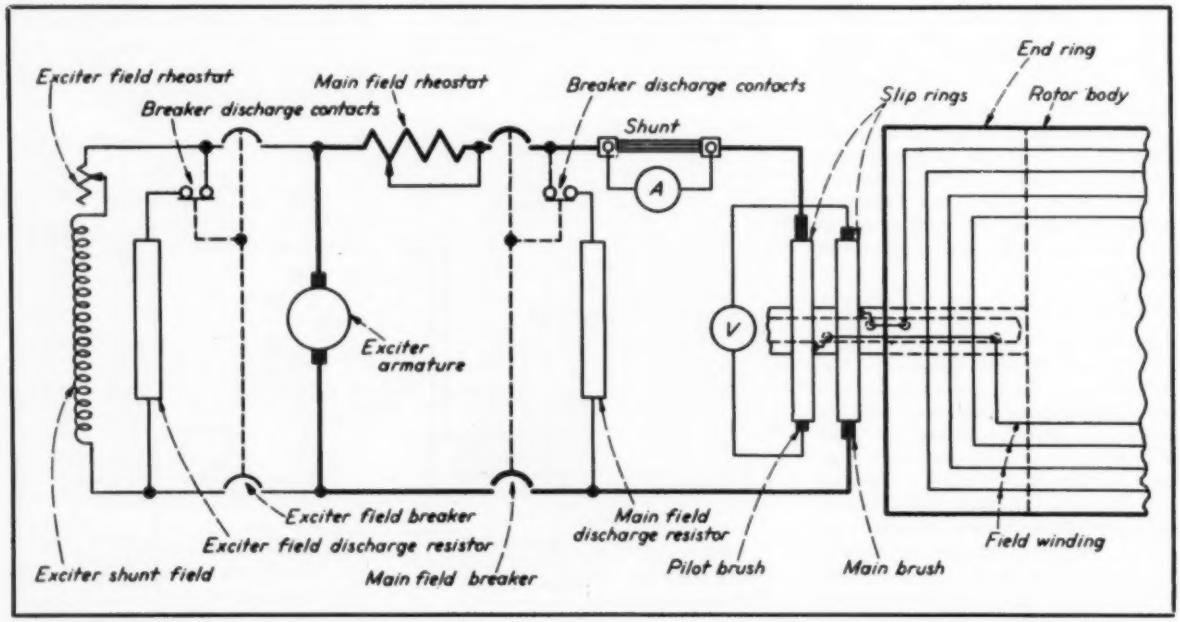


Fig. 1—Pilot brushes are used in this arrangement for the voltmeter-ammeter method of measuring rotor temperature by the fall-of-potential principle. Then the temperature is computed from resistance.

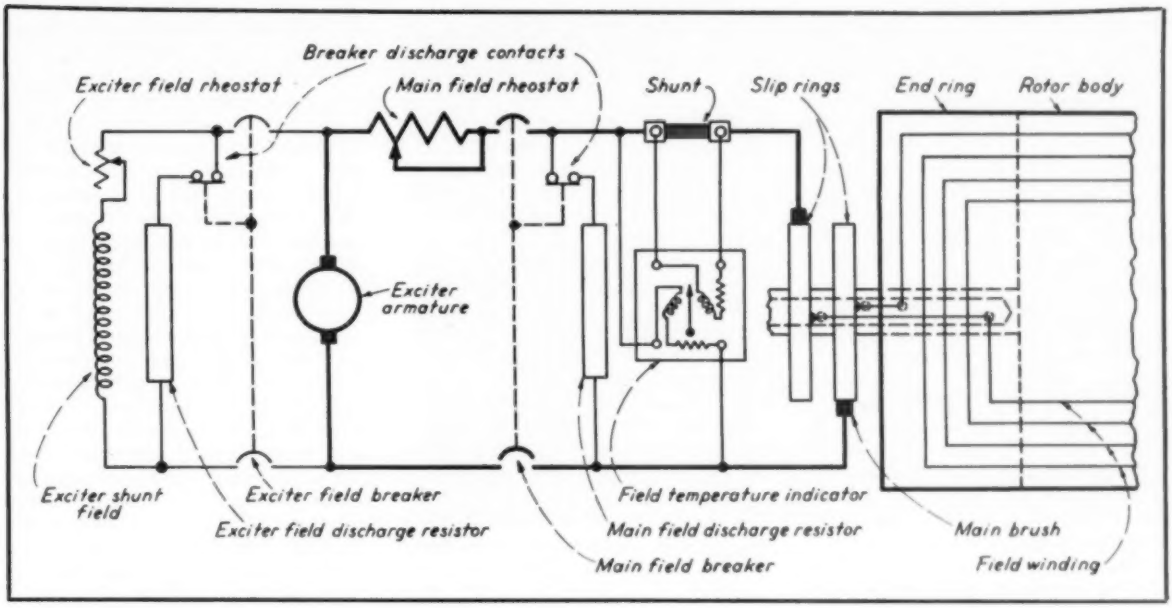


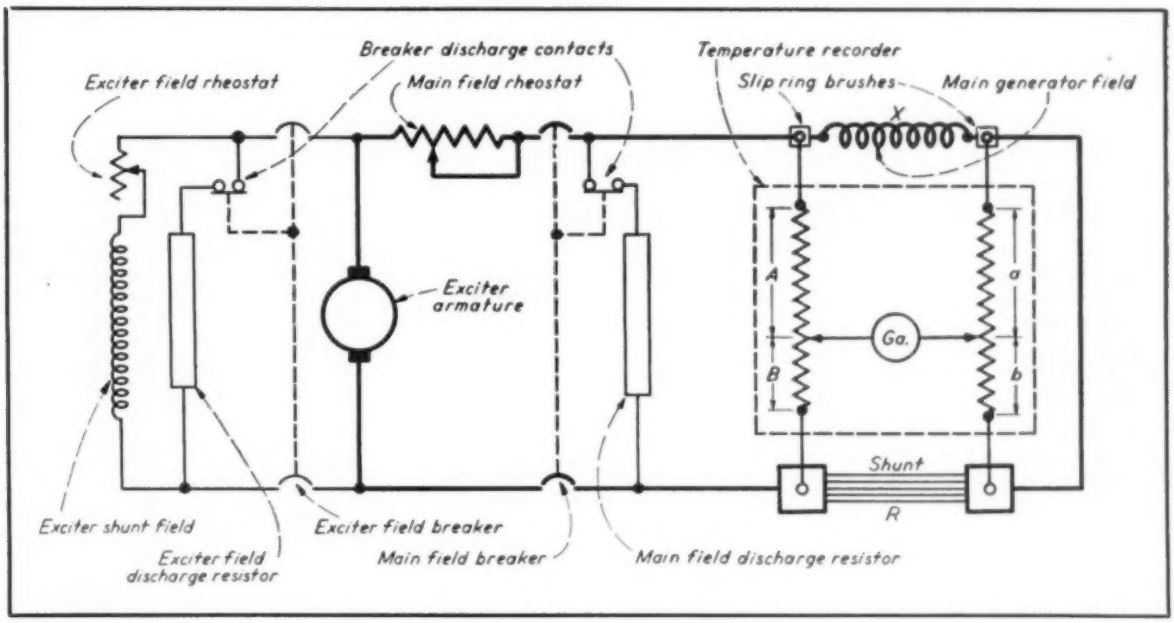
Fig. 2—Indicating instrument connected as shown reads or records directly in degrees, eliminating all computations. Corrections are made for extraneous factors such as brush drop and lead drop.

ings or undue stresses on the end rings. However, with the windings in the slots locked in place by centrifugal action, free thermally caused movement of the windings with respect to the rotor body cannot take place. The result is deformation or a "permanent set" in the windings.

Each cycle of loading and cooling leaves its mark in the form of an increment of deformation. After several such cycles there is a danger of short circuited turns which cause heating at an accelerated rate and bring about more rapid deformation. If such deformation is not symmetrical, excessive vibration may result. Many 3600 rpm machines have had such rotor trouble.

It appears advisable to provide for rotor temperature measurements on all 3600 rpm generators and synchronous motors with the possible exception of small units. A rating of 10,000 kw may be used as a dividing line, with all units of that size or larger equipped with either temperature indicators or recorders. However, even on the

Fig. 3—Bridge-type recorder uses machine circuitry to form bridge; adjusting arms maintain bridge balance. Resistance variations are indicated as temperature changes by arm movements.



smaller units, and on slower speed machines, rotor temperature indicators might be recommended in order to provide a complete picture of machine temperatures. Machines can be much more efficiently loaded if field temperatures are carefully watched.

Thermocouples, or more commonly, resistance elements, are embedded in the windings for measurements of stator temperatures. The connections are brought out to terminal boards, and indicating or recording potentiometers or ohmmeters, scaled in degrees C, are connected to the terminal boards.

Measurement in Operation

For measurements of rotor temperatures during operation, the problem is somewhat different. Thermocouples or resistances embedded in the rotor windings would require special slip rings which would be impractical.

There are two methods in common use for measuring rotor temperatures while the machine is turning. One employs the fall of potential principle; the other, the double Kelvin bridge principle.

The fall of potential principle is often called the "voltmeter-ammeter" method for measuring d-c resistance since these two instruments are the basis of such measurements. By Ohm's Law, resistance changes of the rotor windings are calculated from the changes observed in the voltmeter and ammeter readings. See Fig. 1. Temperature is coordinated with the resistance by the relation:

$$R_2 = R_1 [1 + a (t_2 - t_1)]$$

R_1 = resistance, in ohms, at temperature t_1 in degrees C

R_2 = resistance, in ohms, at temperature t_2, in degrees C

a = resistance-temperature coefficient for the material used in the windings

For copper: $a = .00393$

For aluminum: $a = .00403$

The above relation is not exact, but it is sufficiently accurate for the temperatures and resistances involved in machine rotors.

Indicating and recording instruments especially designed for temperature measurement by the fall of potential principle are now available. These instruments indicate or record temperature directly.

The indicating instrument senses both voltage and current. See Fig. 2. The process of dividing one parameter by another in one dynamometer type instrument is accomplished by a special arrangement of two actuating coils so that their fluxes create the properly related torques throughout the scale range.

It was formerly believed that pilot brushes were needed for the potential connections to the voltmeter, Fig. 1, or voltage-detecting coil in the resistance measuring device, Fig. 2. In this manner, it was reasoned, the error in resistance due to brush resistance would be eliminated. However, because the pilot brushes carried only an extremely small current, a film quickly built up on the surfaces of the brushes and on the slip rings themselves. For this reason, resistance and temperature measurements using the pilot brushes were found to be erratic and inaccurate. Consequently, pilot brushes are no longer used for these measurements, and the potential connections are made across the main brushes, Fig. 2. (The much heavier currents carried by the main brushes constantly burns off any film which might build up).

Manufacturers of instruments for measuring rotor temperatures obtain adequately accurate values of brush drop and brush resistance under full load conditions from the machine manufacturers. The instruments are then compensated for this factor. In general, total brush drop may be estimated with reasonable accuracy at 2 v. Because the brush resistances are usually only a small percentage of the resistances of field windings, errors in estimates of brush resistance have only a very small effect on the temperatures indicated by the instrument. The real value of the readings is for day-to-day and hour-to-hour comparison under similar loading conditions. An increase in temperature of rotor windings over a period of time and under similar loading conditions will indicate that trouble is developing in the field.

To install an indicating temperature instrument on an existing machine rotor, the same shunt which is used for the field current ammeter may be used provided it is a 100 or a 150 millivolt shunt. If it is rated 50 mv, an extra shunt should be added to the circuit, preferably rated 150 mv. For a temperature recorder designed for use with the fall of potential principle, an existing 50 mv shunt may be used.

The principle of the double Kelvin bridge is incorporated in a recording instrument to provide a graphic record of the temperature of a rotor. The fundamental circuit is shown in Fig. 3. The resistances shown within the outline of the instrument are of the slide wire type. Balance of the circuit is continuously maintained by automatic positioning of the two sliding connections of the galvanometer. When the galvanometer reading is zero, the resistances are in the following relation:

$$\frac{X}{R} = \frac{B}{A} = \frac{b}{a}$$

Since the reaction of the recorder is to continuously maintain the galvanometer at zero, a curve is drawn on a chart which is scaled in degrees C, representing the temperature of the rotor winding. Since the field windings are inductive, sudden changes in field current produce transient voltages in the circuit. To prevent false indications of temperature, and possible damage to the galvanometer, a capacitor is shunted across the terminals of that instrument.

In all three diagrams, a main field rheostat, a breaker, and a discharge resistor are shown. In no case are the measurements affected by the presence of such equipment in the circuit.

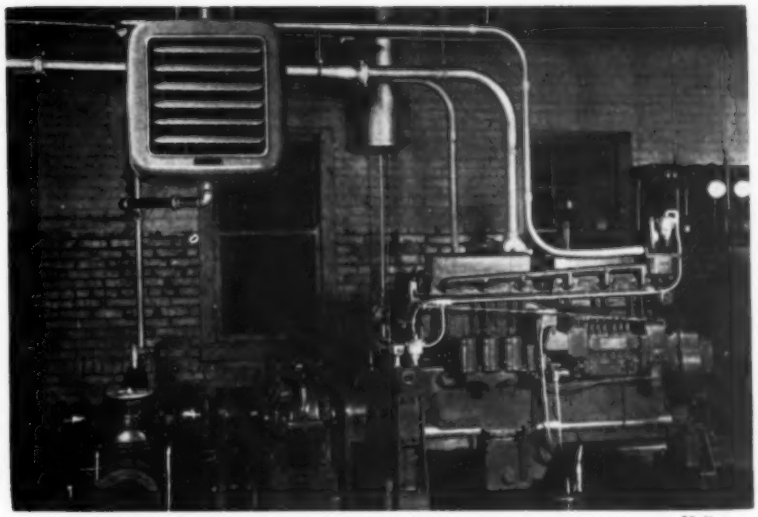
Largest Gas-Filled Motor Drives Centrifugal Compressor

THE WORLD'S LARGEST totally-enclosed gas-filled induction motor was installed recently at the Esso Standard Oil Company's refinery at Everett, Mass.

Built by the General Electric Company's Medium Induction Motor Department, the 14-ton giant is rated at 3000 hp, 1800 rpm, 2300 volt, 3 phase, and is used to power a centrifugal compressor.

The motor is designed especially for application in hazardous locations. Successful application is made possible by the use of instrument air inside the motor enclosure. This air is kept at constant pressure slightly above atmospheric pressure to insure against hazardous gases entering the motor enclosure.

The first gas-filled motor was built by G.E. in 1932, and had a rating of 100 hp at 277 rpm. Since then demands of the growing petroleum industry have led to larger motors for use in hazardous locations.



Unit heaters recover and distribute waste heat from diesel engine in municipal water works.

Moline

Cut Plant Heating Costs With Waste Btu's

Tie unit heaters to an engine or compressor cooling system and credit the fuel savings to operating costs! This method is used by Schramm for a compressor installation and by a municipal power plant for a diesel engine group.

HEAT REJECTED from stationary diesel, gasoline, and gas engines as well as from air compressors can be utilized to reduce plant heating costs. So called waste heat, recovered and distributed by unit heaters, replaces Btu's which would normally be supplied by burning additional fuel. Furthermore, the expense of installing the unit heaters and piping required to recover this heat is often paid for in a few heating seasons.

Air compressors, during the compression process, generate heat. Usually, this heat is dissipated in the intercoolers and after-coolers of the water cooling systems.

Thus, between the fuel entering the compressor driving engine and the compressed air leaving the after-cooler, there is a considerable loss of fuel energy in dissipated Btu's. Fortunately, however, there are numerous opportunities to recover this waste heat and utilize it for space heating in the plant area with unit heaters or convectors.

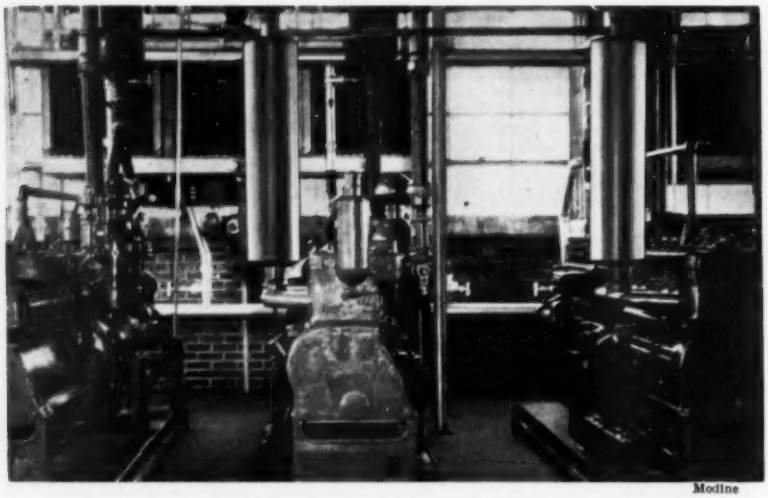
The type of heat recovery system to be employed is determined by the amount of waste heat which can be salvaged and the uses for which it is intended. Whatever arrangement is chosen, the cost of the heat recovery system must not be out of proportion to the fuel savings.

Schramm Inc. installed three 315 cfm compressors in their West Chester, Pa., plant. Two of these were diesel driven, the other a gas-engine driven unit for compressing air.

As a first step in securing maximum heat recovery, the engines were equipped with marine type water-cooled manifolds. Each compressor and engine has a common cooling system. Water flows through the compressor cooling system, compressor jackets, engine jackets, and on to the water-cooled manifolds. Normally this cooling water would be pumped to a large radiator and the heat dissipated to the outside of the building by a fan. However, in the Schramm plant, the heated water is pumped through unit heaters which heat the plant area.

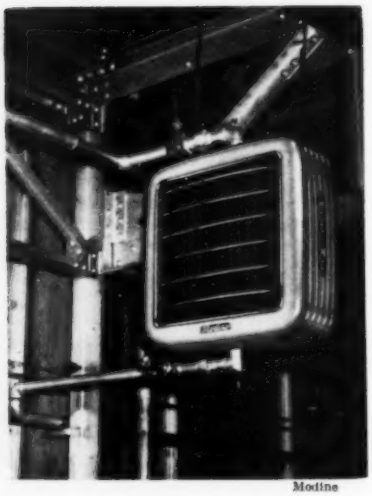
As the units are often operated simultaneously, the heated cooling water is discharged into a common header located on the suction side of a circulating pump, Fig. 1, that discharges to the unit heaters. This arrangement permits unit heaters to operate independently of one another. Furthermore, the different pressure heads on the engine pumps cause no circulation difficulties. Each engine-compressor unit discharges hot cooling water to the header and the water is then pumped through the circulating pump.

Circuits are valved at strategic points to permit easy maintenance and also to permit balancing of cooling water flow to engine and compressor sets. Piping is in accordance with hot water system requirements and an expansion tank with overflow provision is pro-



Modine

Water-cooled exhaust manifolds increase the heat recovered from engine compressor units for distribution by the unit heaters.



Modine

Regular steam or hot water type unit heater mounted from roof.

vided for release of entrapped air. Large cooling radiators dissipate the waste heat during the summer months.

Saves Dollars

Heat recovery in the Schramm installation amounts to approximately 1250 Btu per hour per cfm of compressor capacity at 100 psi. Thus, at full load, each engine-compressor unit delivers about 400,000 Btu per hour into the space heating system. Sizable fuel savings are made possible.

Fig. 2 illustrates an industrial installation of three diesel electric sets in which the heat recovery system is responsible for saving an estimated 700 gal of fuel oil (for oil-fired boiler) per month. This saving is credited to the monthly operation cost of the diesel electric sets, which reduces the cost of the electricity generated.

In this installation, the engine jacket water and exhaust gases represent the sole source of usable heat. Jacket water is circulated for several uses: 1) unit heaters; 2) convectors; 3) boiler makeup water; and 4) shower and wash water. Engine exhaust gases heat the boiler feed water.

After passing through a surge tank, a portion of the engine jacket water is circulated through convectors in the plant office. When office temperature demands are satisfied, the circulating pump on this circuit stops and this water is by-passed to two unit heaters and a heat exchanger.

Should the jacket water temperature rise to a temperature higher than recommended for these engines, a control in the surge tank starts one of the unit heater fans. When operation of one unit is inadequate to handle the cooling demands, a second control starts the other unit heater fan. Inasmuch as the combined capacity of the two unit heaters is well in excess of the Btu requirements for cooling the three engines, adequate cooling is possible at all times. A damper arrange-

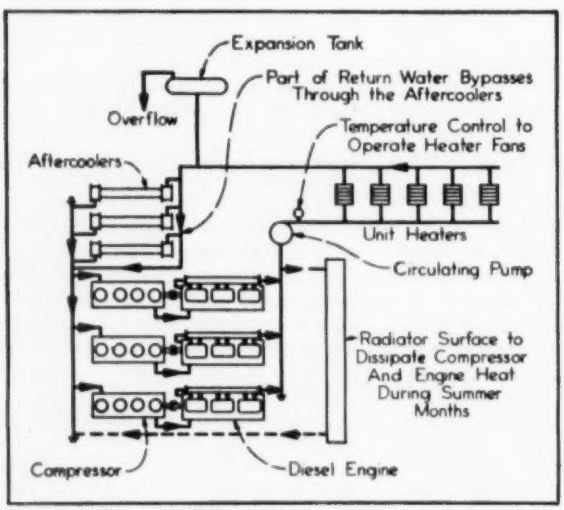


Fig. 1—A diagram of the Schramm compressors showing flow of cooling water through a closed circuit.

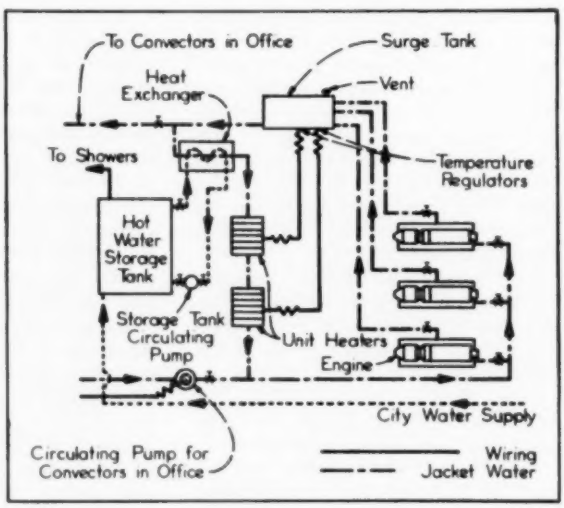


Fig. 2—In the power plant installation the jacket water and exhaust are the sole source of usable heat.

ment permits heat from the unit heaters to be directed into the factory or to the outside of the building.

Unit Heat Controls

Unit heaters on a heat recovery hookup are controlled in the same manner as on a regular hot water heating system. Room thermostats may operate units individually or in groups. An aquastat is recommended to keep unit heater fans from operating until the water temperature reaches a predetermined level. This prevents the units from blowing cold air.

Summer Heat Dissipation

If unit heaters dissipate engine or compressor heat during the summer months, they are provided with ducts which permit the heated air to be bypassed to the out-of-doors. The units are located as close as possible to an exterior wall, although occasionally, the ducts can be extended through the roof for centrally located heaters. Normally, ducts extend just far enough from the units to allow room for quadrant dampers, with one branch curving off to an outside wall or through the roof. Ducts can be omitted when units that can be rotated are located near windows so the heated air can be discharged directly.

Where neither of these schemes is practical, jacket water can be circulated through outside radiators or other cooling systems to dissipate the heat in summer weather.

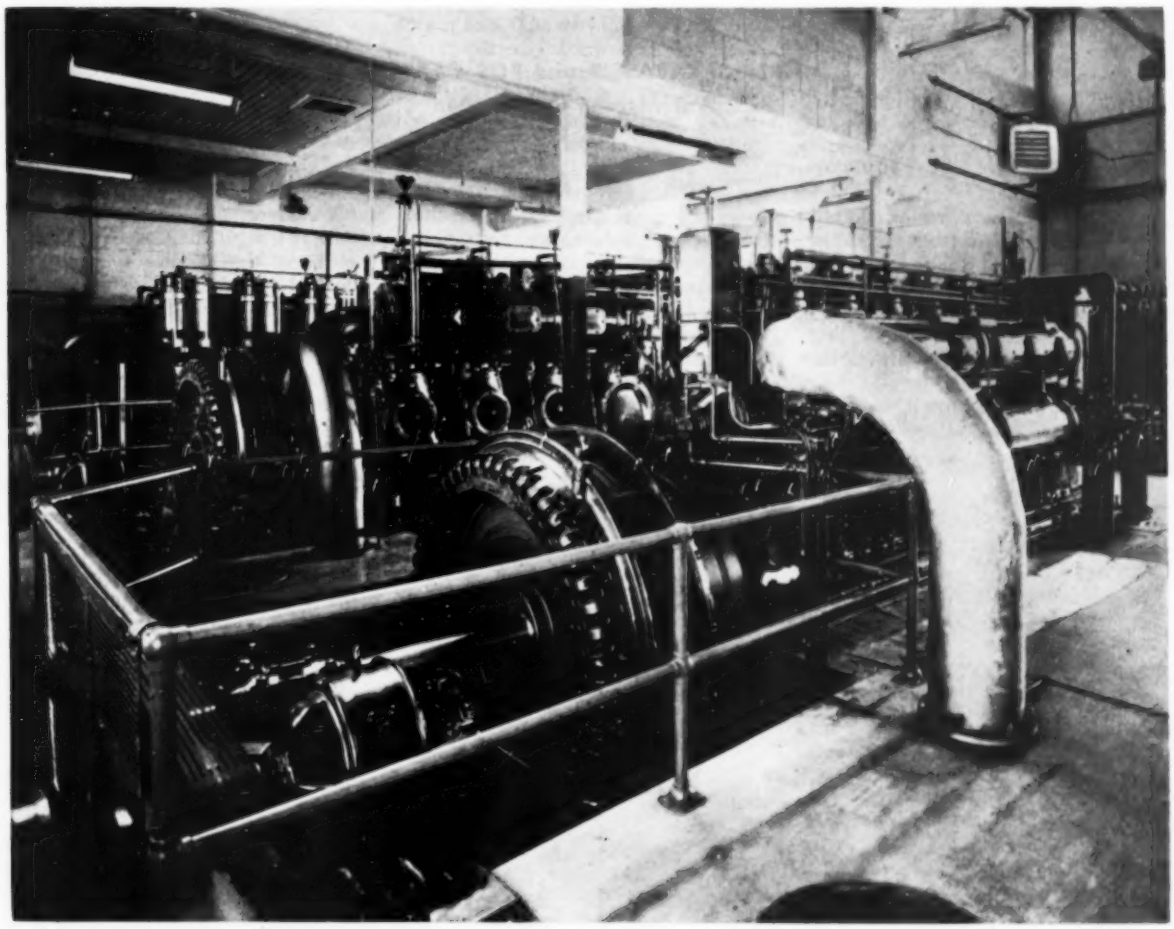
Selecting Heaters

Because jacket water temperatures are considerably lower than steam temperatures, there is an advantage in using unit heaters specifically designed for hot water heating. These hot water models are provided with more heat transfer surface. . . . thus offering greater heating capacity and higher discharge air temperatures. However, under normal conditions, standard steam models will perform satisfactorily, and the final temperatures can be brought within the comfort range.

In sizing unit heaters for a heat recovery or dissipation system, the quantity and outlet temperature of the jacket water available, as well as its rate of flow through the unit heater must be considered. Having this information, it is possible to select the correct unit heaters from manufacturers' tables. Unit heater selection will also be influenced, of course, by the space heating or heat dissipation requirements and location.

Economically Justified

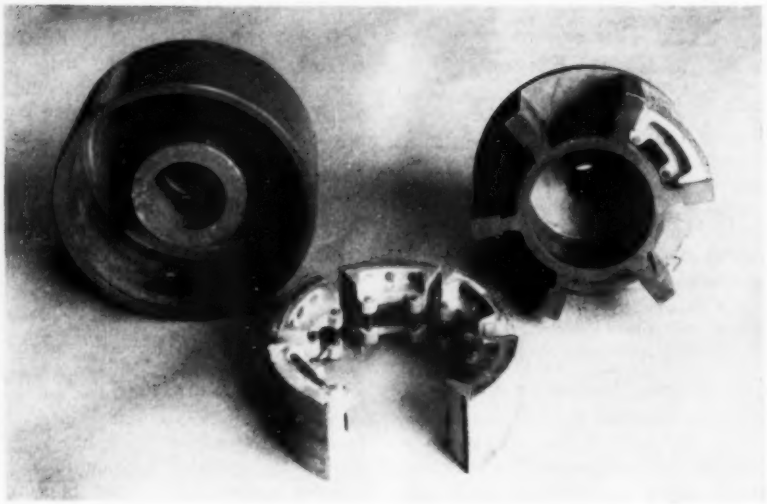
In those installations where the recovery and distribution of reject heat in engine or compressor coolants can be established as being economically sound, users benefit from both a reduction in their heating costs and a simplification of their engine heat dissipation problems. However, where a heat recovery system is being considered, comparing the estimated cost of the system against the savings and benefits which it can be expected to provide, is essential.



Moline

Heat recovered from diesel-electric generators in light and power plant is utilized by unit heaters for comfort heating.

A clutch type coupling uses faced weights which engage the drum surface through centrifugal force.



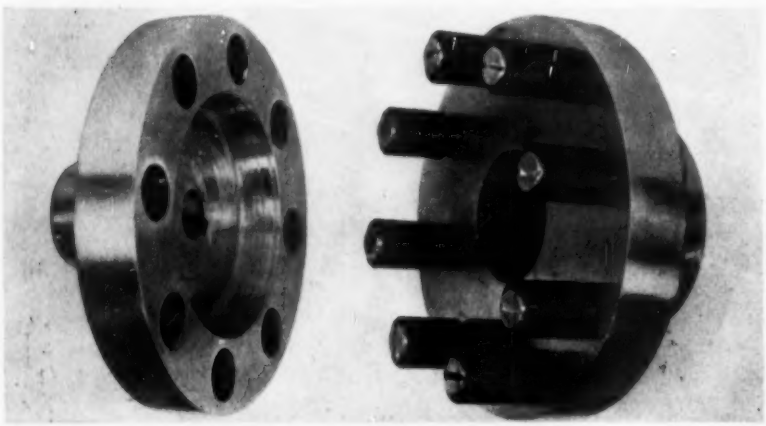
Couplings and Baseplates

Centrifugal Pumps

IGOR J. KARASSIK and ROY CARTER
Worthington Corporation

A COUPLING which permits no axial or radial relative motion between the driving and the driven shafts is a rigid coupling. It solidly connects the two shafts, in effect, making them a single shaft. Use of the rigid coupling on pumps is restricted mostly to the vertical type pump.

A clamp coupling is a modified form of a rigid coupling. It consists basically of a split sleeve with bolts so arranged that it can be clamped on the adjoining ends of two shafts to form a solid connection. Keys, both axial and circular, are commonly incorporated so that the transmission of torque and thrust is not solely dependent upon the frictional grip.



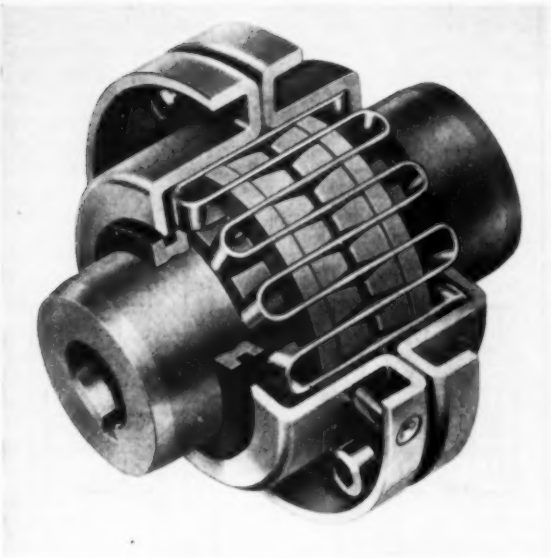
Pin and buffer couplings compensate longitudinally by sliding action of the bolts while angularity is compensated by flexible rubber buffers.

A compression coupling is another form of a rigid coupling. The central portion of the coupling is made of a slotted bushing, bored to fit the two shafts and taper-machined on its outside diameter from the center out to each end. The two coupling halves are finish bored to suit this taper. When drawn together by bolting, the bushing is compressed to the two shafts and the frictional grip transmits the torque without the use of keys.

Flexible Couplings

A flexible coupling is a connecting device joining the ends of two shafts, capable of transmitting torque from one shaft to the other, and of a design that permits proper transmission of the torque with minor misalignment (angular, parallel or both) of the shafts. However, while flexible couplings will take care of slight errors in alignment of shaft centers in emergencies, such a condition must not be tolerated permanently, as it is undesirable. Misalignment allows whipping of the shaft and additional thrust on the bearings and causes excessive maintenance or breakdown repairs.

A pin and buffer arrangement is a commonly used form of flexible cou-



Stresses in the spring members of the Falk flexible coupling are almost constant for coupling load ranges.

Operating in an oil bath retained in the shell, gear teeth transmit torque in gear type flexible coupling.

pling. Pins attached to one half of the coupling project into buffers mounted in the other half. The buffers are made of rubber or other compressible material to give flexibility. The driving bolts have an easy sliding fit in the bushings, and slight longitudinal variations are taken care of by the sliding action of the bolts within the bushings. Slight errors in angularity are taken care of by the flexibility of the rubber.

There are several types of all metal flexible couplings. Some of these depend on the flexibility of metal plates or springs. Others depend upon angular displacement, using two splines with a connecting splined sleeve.

The gear type flexible coupling has in its outer shell, inside of each end, a ring of internally cut gear teeth which mesh with the gears on the driving and driven halves of the coupling. The torque is transmitted through the gear teeth. Some sliding action and slight adjustment in position is provided by a limited freedom of action between the two sets of teeth. To prevent any tendency to bind as a result of friction, the gears operate in a constant bath of oil which is retained within the shell.

Another type is the Falk flexible coupling, which is an all-metal coupling with grease lubrication. It consists of two flanged steel hubs, a special tempered steel spring forming a complete cylindrical grid, and a steel shell cover. The peripheries of the hubs are slotted to receive the spring member. The slots widen inwardly towards each other. This widening is in the form of an arc, bearing a definite relation to the thickness of the grid spring bars. The curvature is such that the points of support approach each other as the load increases. In fact, the slots are so formed that the stress on the spring members remains almost constant throughout the entire elastic range of the coupling.

There are numerous other types of all-metal flexible couplings, each with its own advantages and limitations. The extension or spacer sleeve type of coupling for example is used on pumping units handling hot liquids, where expansion may result in misalignment. Their purpose is to protect against considerable misalignment with a minimum separation of the driving and driven shaft ends. This coupling usually has two single engagement elements connected by a sleeve.

The floating shaft coupling has two flexible elements connected by a shaft. Designs vary as required by the basic coupling conditions. For instance, each of the two couplings may be of the single engagement type; they may consist of a flexible half-coupling and a rigid half-coupling at each end; or they may be complete flexible couplings with some guiding arrangement provided.

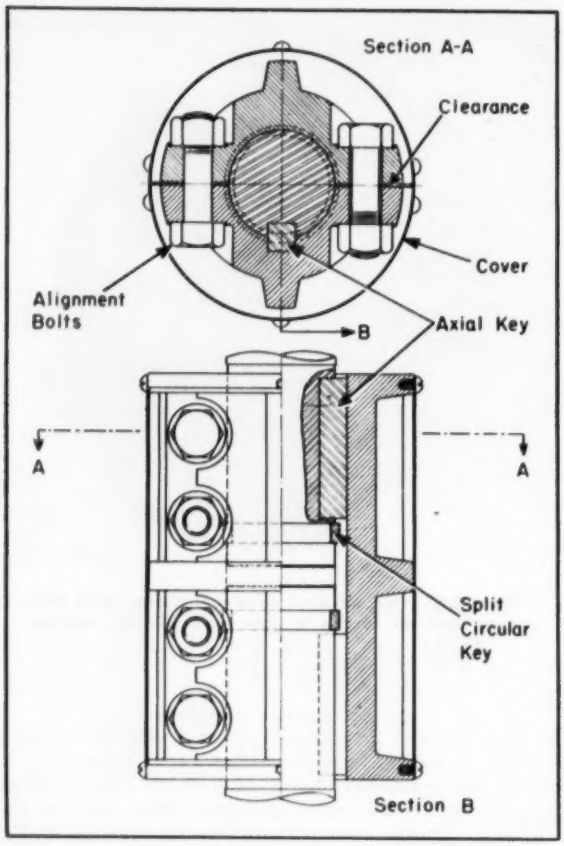
In the smaller horsepower field (below 25 hp and 100 rpm) "flexible drive shafts" are commercially available. These use universal joints at each end with a tubular floating shaft body and a splined portion to provide for length variation. These floating shaft and flexible drive shaft types find considerable application with vertical dry pit pump installations.

Regular disc-type clutches are rarely used to connect a centrifugal pump to its driver. Most clutch designs impose a high additional thrust load on the pump thrust bearing, and this design also requires a very accurate alignment between the clutch parts which is difficult to maintain. However, the overrunning clutch design has been used to connect drivers to pumps, particularly dual driven units. The most successful designs have a flexible coupling incorporated into the clutch unit. A clutch type coupling utilizing faced weights which are contained in the driver half and which are pressed against a drum surface on the driven half by centrifugal force are also used.

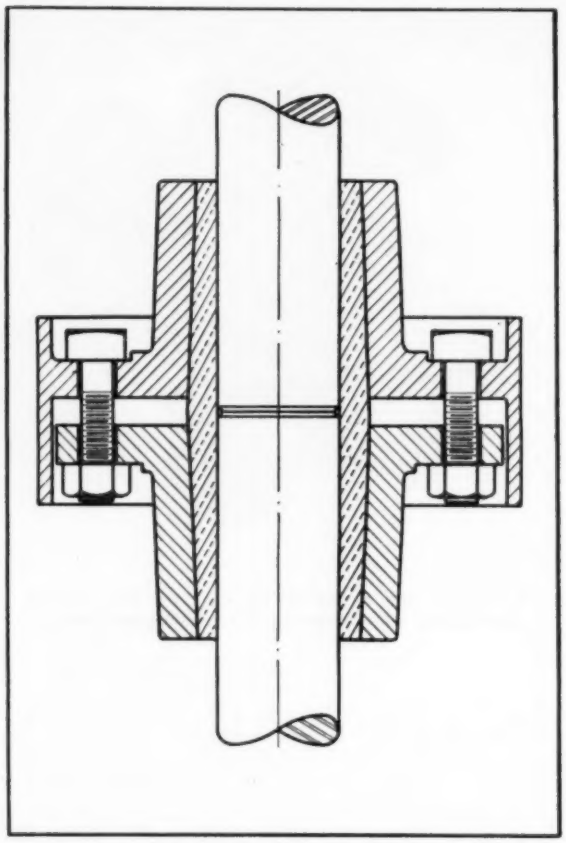
Couplings for Dual Drive

In dual driven pump installations it is generally desirable to have one driver idle, either to save power or to save wear on the idle machine. The ideal type of couplings for such units are those which can be readily engaged and disengaged. The chain type, quick disconnecting coupling is suitable to these applications. Another cut-out coupling makes use of a sleeve which can be slid into and out of engagement and held in the desired position with locating pins. This is a quick and simple operation for this coupling.

Where time is of extreme importance, or, when the starting of the standby driver is automatically controlled, a device of the free wheeling clutch type is helpful. A coupling suitable for this service is a clutch type



Both axial and circular keys are incorporated on a clamp coupling to help transmit the torque and thrust.



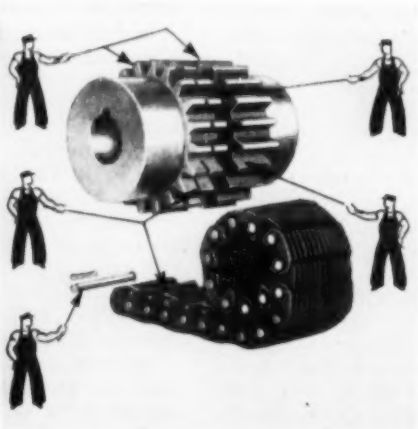
Frictional grip of bushing on two shafts transmits the torque without keys on a compression coupling.

coupling with spring retained shoes in the driven half. These shoes can be controlled so that no engagement of shoes takes place until after a desired speed is reached. Above this speed centrifugal force causes the coupling to automatically pick up the load. The tension of the springs is just sufficient to overcome the weight of the shoe, or there may be sufficient tension to allow a pump to be driven by a motor on one side while an internal combustion engine is idling without carrying any of the load on the other side. Bringing the engine up to speed engages the coupling at the desired point.

Chain type coupling halves show its construction.

Guide links fit grooves and keep chains in place.

Removing cotter pin helps remove chain to quickly open coupling.



Finished flat steel hardened gear faces are easily aligned.

Smooth teeth permit quiet and efficient operation.

For quick engaging or disengaging, the chain coupling is recommended.

Hydraulic Couplings

Magnetic clutches are rarely used to connect a centrifugal pump to its driver. This device again requires accurate alignment. Those few installations that have been made have not been very successful and have had high maintenance costs.

The one application in which a magnetic clutch might be used to advantage is for pumping into accumulator tanks (or similar service) where the demand varies over a wide range. It is now the practice either to start and stop the entire pumping unit or, if the cycle is too frequent for that, to allow the pump to operate at reduced capacity during the period of small demand. If the demand will at times become too small for proper operation, a by-pass can be incorporated so the capacity never falls below a safe value.

Both hydraulic couplings and mag-

netic drives are used with centrifugal pumps where operating conditions warrant these variable speed devices. They have approximately the same over-all efficiency as slip ring motors with speed control. They also have the advantages of producing any desired output speed whereas the regular control for slip ring motors permits adjustment of speed only by steps.

Bedplates

The primary function of a pump bedplate is to furnish mounting surfaces for the pump feet. Mounting surfaces are also necessary for the feet of the pump drives or drivers or any independently mounted power transmission device used to connect the driver to the pump. Such surfaces could be provided by separate bedplates, but then it would be necessary to align these separate bases and fasten them to the foundation with the utmost care. This would require mounting them in the field, and drilling and tapping for the holding down bolts after all the parts of the unit have been aligned. To minimize this field work, most pumps are purchased with a continuous base extending under the pump and its driver, both being mounted and aligned at the factory.

Bases are designed to be quite rigid, but they will deflect if improperly supported. It is necessary, therefore, to support the base on a foundation that provides full rigidity. Since the base can be sprung out of shape by improper handling during transit from the place of manufacture to its point of installation, the alignment must be carefully checked during erection and prior to starting the unit.

The size and weight of the base is proportional to the size of the pump and driver. In very large units the cost of a base exceeds the cost of the field work necessary to align individual bedplates or soleplates and to mount the component parts of the unit on these supporting surfaces. Here, it is cheaper to omit the continuous base.

There are instances where a considerable difference in the height between pump and other elements of the unit exist, and individual bases with built up foundations are recommended. In many installations it is less expensive and equally practical to use bedplates fabricated of steel plate and structural steel shapes instead.

Centerline Support

For operation at high temperatures, the pump casing must be supported as near to its horizontal centerline as possible. Temperature differences might otherwise seriously strain or disturb the alignment of the unit and cause eventual damage to the pumping equipment. This type of construction is generally employed with refinery pumps which handle hydro-carbons at high temperatures. It is also used for heater drain and boiler feed pumps operating at temperatures approaching or in excess of 300 F.

No Strain on Pump Bearings with Flexible Metal Hose

A FLEXIBLE METAL HOSE connected to the suction and discharge sides of an oil pump allows the fittings to be drawn snug without placing any undue strain on the pump bearings or housing.

Solid pipe was initially used for these lines. However, when the connections were tightened, any slight misalignment between the rigid pipe and the pump fittings, tended to distort the pump housing. In turn, this caused a considerable strain to be exerted on the bearings. The resulting wear made it necessary to repack the bearings twice a year.

Faced with this heavy maintenance burden, it was decided to investigate flexible hose as a replacement for the solid pipe on the discharge and suction lines. Rubber hose or fittings could not be used because the fuel oil in the system would attack the rubber.

A standard all-metal flexible hose with brass inner-core and bronze round wire braid was recommended. When the hose was assembled, it was made slightly longer than the distance between the connected points. This additional length and the "give" in the flexible hose was sufficient to allow the fittings to be completely tightened without exerting any pull on the pump bearings or housing.

Although there are no special pressure, temperature, or vibrational considerations, it is important that all joints be kept leakproof. Fuel oil leaking on the floor could create a real fire or safety hazard in the plant.

Mr. W. J. Heim, maintenance superintendent of the Wheatena plant in Rahway, New Jersey, has stated that in the five years that the lines (made by the Titeflex Co.) have been in place it has not been necessary to repack the pump bearings at all.

Wheatena has also adapted metal hose for water connections in their cooling towers. Rubber hose was first used for the water lines, but it was found that the hot recirculated water caused the rubber to swell and made it difficult to control the amount of water circulating in the cooling system. Metal hose not only eliminated the swelling and gave an even flow of water, but because of its flexibility, also allowed the towers to be moved for cleaning purposes.

Titeflex

A fuel-oil pump at Wheatena Corp. showing Titeflex metal base hose used on suction and discharge lines to eliminate strain on the pump bearings.

Instruments Indicate

Turbine Shaft Distortion

LEO WALTER, *Consulting Engineer*

This supervisory panel contains both indicating and recording instruments.

WHEN STEAM is applied to a turbine preparatory to starting up, the rotor, having less weight and heat capacity than the casing, heats up more quickly. This causes the shaft to expand in relation to the casing, and care must be taken to see that this expansion does not exceed the clearance allowed at various points within the turbine. Movement also takes place when there is any sudden change in load or when the machine is being shut down.

If during the starting period there is unequal application of heat around the rotor, the resulting unequal expansions tend to bend the shaft slightly. This causes those parts of the rotor not adjacent to the bearings to rotate eccentrically, and out-of-balance forces are set up which tend to increase the distortion of the shaft. Thus, due care must be exercised, as it is possible for the eccentricity of motion to exceed radial clearances so that rubbing and consequent damage could occur.

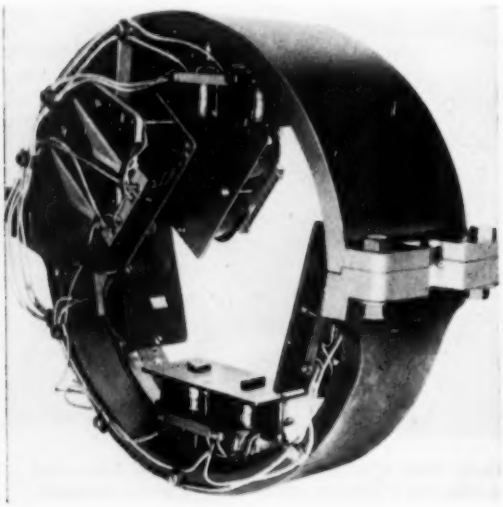
In order to reduce these dangers, it is customary to start the turbine according to a time schedule set to assure fairly uniform heating. Then the possibility of clearances being reduced below those allowable for safe operation is avoided. In many plants, however, this period could be shortened if precise knowledge of the relative displacements in the turbine were continuously available. With this information, starting time could be safely shortened, particularly at critical load periods. Furthermore, the record of the shaft movement correlated with rotational speed throughout the life of the turbine would reveal any progressive deterioration and would permit analysis of machine performance.

Supervisory equipment for indicating and recording shaft distortion is being installed on six, 60 mw turbines for a new generating station in England. Developed by The General Electric Co., Ltd., the equipment was connected to the first of these turbines during the initial steam trials. The distortions of the shaft, though small, were easily observed, and extremely accurate information on the relative movements of the parts was obtained.

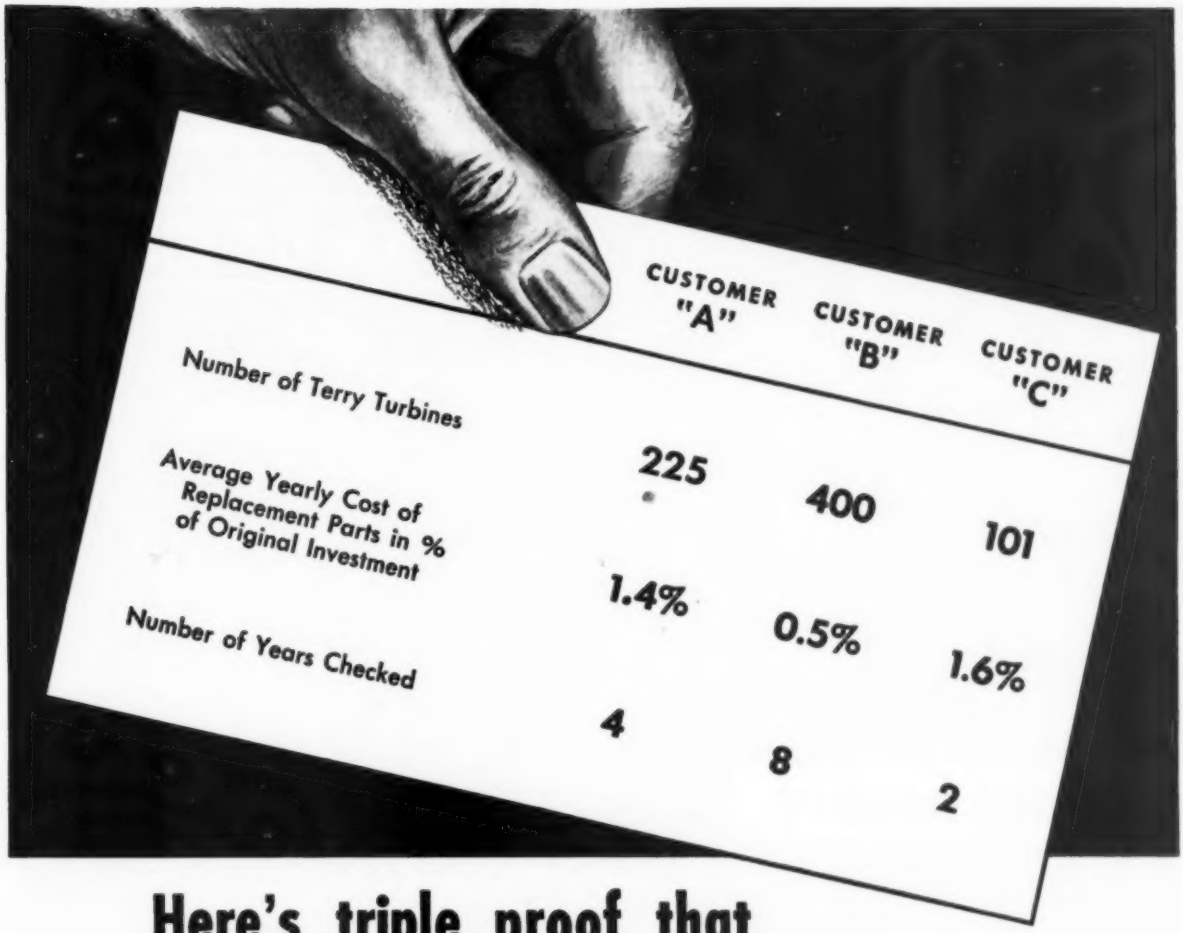
With the equipment that has now been developed, three sets of detector coils are mounted inside the turbine. One set measures axial displacement, another measures vertical eccentricity and displacement, and the third measures horizontal eccentricity and displacement. These instrument readings give a clear picture of any distortions taking place within the turbine while it is actually running. The equipment is independent of the normal voltage or frequency variations of the electric supply, and has the same degree of reliability as the turbine.

In addition to the above measurements, the equipment provides values of the mean position of the shaft with respect to the bearing housing, in both vertical and horizontal directions. Thus, the position of the shaft journal with respect to the bearing and its oil film is available. Auxiliary equipment also has been developed, for occasional use during special investigations, which displays to an enlarged scale, on the screen of a cathode ray oscilloscope, a polar diagram of the motion at the end of the shaft.

Additional apparatus has been developed to measure and record the speed of the turbine, using a small high-frequency alternator from the turbine shaft. As the turbine speed increases, the output from the generator is fed directly to the indicating and recording instruments until a speed of about 2750 rpm is reached. At speeds above this, the output is switched automatically to tuned circuits before being fed to the instruments. Two scales of equal length are provided on the indicator, calibrated 0 to 3000 and 2700 to 3300 rpm. The recording instrument has three ranges covering 0 to 3000, 2700 to 3300, and 3200 to 3500 rpm respectively.



Detector coils are used to provide measurements of axial, vertical, and horizontal displacement as well as vertical and horizontal eccentricity.



Here's triple proof that
IT PAYS TO SPECIFY TERRY TURBINES

When you combine the figures for these three customers — a total of 726 turbines — the average yearly cost of replacement parts works out to only 1.1% of the original investment. A truly remarkable record, even when you realize that they are Terry turbines.

But, the cost of replacement parts is only the beginning of the story. The real savings are in the labor costs and production losses which are reduced so drastically when you install Terry turbines.

Send for further information about these low-maintenance turbines. Bulletin S-116 describes the many advantages of the Terry solid-wheel turbine. For multistage turbines, ask for a copy of Bulletin S-146.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1196

G.E. Announces New Rigid Conduit

A new G-E WHITE rigid steel conduit that has easy bending, easy wire-pulling, and improved corrosion-resistance characteristics has been introduced by General Electric's Construction Materials Division.

These improvements have been made possible by a zinc-coating process called "metallizing", which has been proved by more than 30 years of service in other applications. Metallizing bonds a controlled, uniform coating of pure zinc to the conduit, threads and all, to provide lasting protection against corrosion. The conduit is then given the added protection of a coating of C-553 lacquer over the metallized zinc.

New G-E WHITE rigid conduit conforms with the American Standards Association specifications, is listed by Underwriters' Laboratories, Inc., and meets all U. S. Government specifications. Ask your distributor about it. Section C25-944, Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

New G-E WHITE is easier to bend because the "metallizing" process flame-coats the zinc to the conduit—eliminating the quenching and straightening that cause hardening.

Wire-pulling is easier because new G-E WHITE is lined with a new corrosion-resistant coating, containing an anti-friction agent.

You can put your confidence in—

GENERAL ELECTRIC

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

Aluminum - Copper Conductor Equivalence

THE RECENT critical shortage and present high cost of copper has greatly encouraged the use of aluminum as a conductor. Because of the almost universal prior use of copper as an electrical conductor, aluminum is presently often thought of in terms of the equivalent copper conductor when dealing with such factors as current carrying capacity and regulation.

Many years ago, current capacity tables were established by the cable industry for copper. Additional tables are listed by the Insulated Power Cable Engineers Association for the a-c/d-c resistance ratios of copper conductor. The table (below, left) shows conversion factors, taking both these factors into account. Multiplying these conversion factors by the current rating of a given copper conductor cable will give the current carrying capacity of the identical cable having aluminum conductor. This table of conversion factors is based on aluminum conductor of 61 percent conductivity.

The table (below, right) shows current carrying capacities for three-conductor cable and compares capacity of copper and aluminum for 15-kv grounded neutral, shielded, varnished cambric, lead covered cable, and 5-kv, belted, varnished cambric, lead covered cable in underground ducts with three loaded cables in each duct bank. The load factor assumed is 75 percent and the earth ambient temperature is taken as 20 C.

The other tables, showing cable sizes for equivalent current carrying capacity (right, above) and equivalent voltage regulation (right, below), are for the same cables described in the preceding paragraph. The size selections are made by selecting the nearest Awg or mcm size in 50-mcm steps. In general, the equivalent sizes given in this table for current carrying capacity apply to most cables and for usual installation conditions for small and medium conductors. For larger sizes of cable, at higher voltages and under heavier duct loading, larger sizes in aluminum than indicated may be required. This trend is borne out by the table showing 800-mcm aluminum cable as equivalent to 500-mcm copper cable at 15 kv whereas 750-mcm aluminum is shown equivalent at 5 kv.

The table comparing sizes of these cables for equivalent voltage regulation is based on operation at the power factor producing maximum voltage

THREE-CONDUCTOR VCL CABLE FOR EQUIVALENT CURRENT RATING

Copper Awg or mcm	15 KV Aluminum Awg or mcm	5 KV Aluminum Awg or mcm
4	2	2
2	0	0
1	00	00
0	000	000
00	0000	0000
000	250	250
0000	350	350
250	400	400
350	550	550
500	800	750

G-E, *Distribution*

These equivalences are generally applicable to most installations.

THREE-CONDUCTOR VCL CABLE SIZES FOR EQUIVALENT VOLTAGE REGULATION

Copper conductor Awg or mcm	15 KV Aluminum conductor Awg or mcm	5 KV Aluminum conductor Awg or mcm
4	2	2
2	0	0
1	00	00
0	000	000
00	0000	0000
000	250	250
0000	350	350
250	400	400
350	550	550
500	800	800

G-E, *Distribution*

This data is based on power factor producing maximum voltage drop.

Aluminum Cable Current Carrying Conversion Factors

Conductor size	Single conductor cable standard stranded	Three conductor cable
Up to 3 Awg	0.779	0.779
2 and 1	0.779	0.782
0	0.779	0.785
00	0.779	0.788
000	0.779	0.790
0000	0.779	0.792
250 mcm	0.780	0.793
300	0.780	0.794
350	0.781	0.795
400	0.782	0.799
500	0.783	0.803
600	0.785	0.806
700	0.787	0.808
750	0.790	0.812
1000	0.794	—
1250	0.804	—
1500	0.810	—
1750	0.817	—
2000	0.827	—

G-E, *Distribution*

TYPICAL CURRENT CARRYING CAPACITIES THREE-CONDUCTOR CABLE

Conductor size	15 KV, Shielded VCL Cable Copper conductor	15 KV, Shielded VCL Cable Aluminum conductor	5 KV, Belted VCL Cable Copper conductor	5 KV, Belted VCL Cable Aluminum conductor
4 Awg	98 amp	76 amp	96 amp	75 amp
2	128	100	124	97
0	163	128	162	127
00	185	146	185	146
000	210	166	211	167
0000	236	184	240	190
250 mcm	259	205	263	208
350	309	246	319	254
500	369	296	386	310
750	445	361	475	386

G-E, *Distribution*

Conversion factors (left) multiplied by current carrying capacity of copper-conductor cable gives capacity of identical cable with aluminum conductor. Table above is based on conversion factors at left. Both tables are based on IPCEA table of copper ratings.

drop. Then the voltage drop per phase equals the current times the impedance to neutral.

A general table of equivalent conductors is shown for a wide range of sizes based on R and RH insulations. The type R is the National Electric Code minimum standard rubber insulation. It is the lowest cost grade acceptable for NEC building construction requirements; type R is used in industrial wiring for light and power applications.

Type RH is designed for greater current carrying capacity and better aging. It may be used wherever type R is used and in any other power or control cable application where exceptionally high heat resistance and long life are desired.

The final table shows equivalent sizes for a widely used class of motor wiring applications with various common insulations. The RU type is a non-milled grainless rubber insulated conductor which is moisture resistant and flame retardant; it is generally used in conduits, raceways, or on insulators. The type RW is similar to type R but has superior moisture-resistance qualities.

CURRENT CARRYING CAPACITY OF ALUMINUM AND COPPER

Size	Conductors in conduit			Conductors in open air		
	RH copper	R copper	RH aluminum*	RH copper	R copper	RH aluminum*
6 Awg	65 amp	55 amp	55 amp	95 amp	80 amp	79 amp
4	85	70	71	125	105	105
3	100	80	84	145	120	122
2	115	95	96	170	140	143
1	130	110	109	195	165	164
1/0	150	125	126	230	195	193
2/0	175	145	147	265	225	222
3/0	200	165	168	310	260	260
4/0	230	195	193	360	300	302
250 mcm	255	215	214	405	340	340
300	285	240	239	445	375	374
350	310	260	260	505	420	424
400	335	280	281	545	455	458
500	380	320	319	620	515	520
600	420	355	353	690	575	580
700	460	385	386	755	630	635
750	475	400	399	785	655	660
800	490	410	411	815	680	685
900	520	435	436	870	730	730
1000	545	455	458	935	780	785
1250	590	495	495	1065	890	895
1500	625	520	525	1175	980	986
1750	650	545	546	1280	1070	1075
2000	665	568	559	1385	1155	1162

* Aluminum RH = Copper RH × 84%.

Aluminum Company of America

Equivalences between copper and aluminum are shown for conductors having some of the widely used insulations for industrial applications. Comparison shows RH-covered aluminum nearly equal in capacity to R-covered copper.

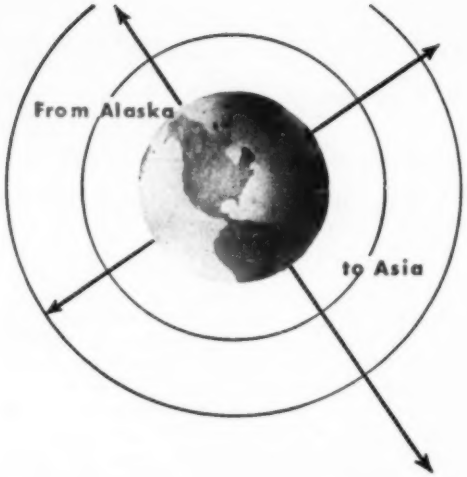
WIRE AND CONDUIT SIZES FOR THREE-PHASE 440-VOLT INDUCTION MOTORS

Motor ratings			Copper conductors						Aluminum conductors					
			Type RU		Type RW		Type RH		Type RU		Type RW		Type RH	
Hp	Full load amps	125% Full load amps	Size cable Awg or mcm	Size conduit	Size cable Awg or mcm	Size conduit	Size cable Awg or mcm	Size conduit	Size cable Awg or mcm	Size conduit	Size cable Awg or mcm	Size conduit	Size cable Awg or mcm	Size conduit
1	1.8	2.25	14	½ in.	14	½ in.	14	½ in.	12	½ in.	12	½ in.	12	½ in.
1½	2.5	3.1	14	½	14	½	14	½	12	½	12	½	12	½
2	3.3	4.1	14	½	14	½	14	½	12	½	12	½	12	½
3	4.5	5.7	14	½	14	½	14	½	12	½	12	½	12	½
5	7.5	9.4	14	½	14	½	14	½	12	½	12	½	12	½
7½	11.0	13.8	14	½	14	½	14	½	12	½	12	½	12	½
10	14.0	17.5	12	½	12	½	12	½	10	½	10	¾	10	¾
15	20.0	25.0	10	½	10	¾	10	¾	10	½	10	¾	10	¾
20	26.0	32.5	8	¾	8	¾	8	¾	8	¾	8	¾	8	¾*
25	32.0	40.0	8	¾	8	¾	8	¾	6	¾	6	1	6	1
30	39.0	49.0	6	¾	6	1	6	1	—	—	4	1¼	6	1
40	52.0	65.0	—	—	4	1¼	6	1	—	—	2	1¼	4	1¼
50	63.0	79.0	—	—	3	1¼	4	1¼	—	—	2	1¼	2	1¼
60	75.0	94.0	—	—	2	1¼	3	1¼	—	—	0	2	2	1¼
75	93.0	116.0	—	—	0	2	1	1½	—	—	00	2	0	2
100	123.0	154.0	—	—	000	2	00	2	—	—	0000	2½	000	2
125	155.0	194.0	—	—	0000	2½	000	2	—	—	300	2½	0000	2½
150	180.0	225.0	—	—	300	2½	0000	2½	—	—	400	3	300	2½
200	240.0	300.0	—	—	500	3	350	3	—	—	600	4	500	3

*Use 1-in. conduit for 2/64-in. jacket.

Aluminum Company of America

Conductor and conduit sizes for copper and aluminum wire having insulations often used with many motor installations.



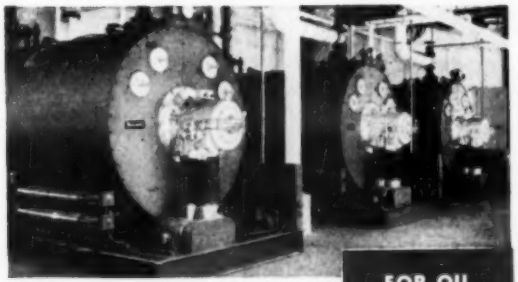
Powermaster®

is a world-wide choice for

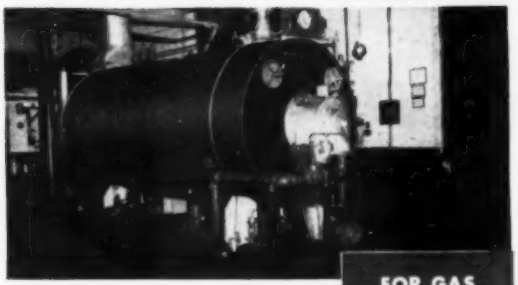
LOW-COST STEAM

All over America—in U.S. Possessions . . . in Canada . . . South America . . . Europe . . . Asia . . . Africa—thousands of *Powermaster* Packaged Automatic Boilers are now supplying steam and hot water requirements—with outstanding reliability and economy for:

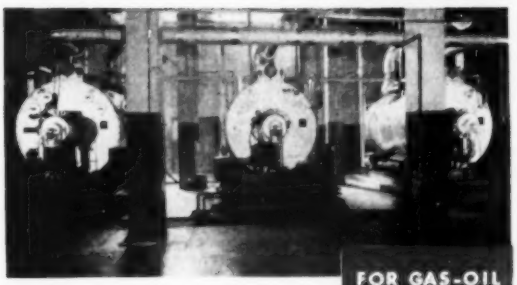
bakeries • beverage plants • canners and food processors • chemical plants • dairies • dry cleaners • hospitals and institutions • hotels • apartment and office buildings • laundries • meat packers • public schools and colleges • tanneries • textile mills • tire and rubber companies • paper mills • railroad shops • manufacturing plants • and many other users.



FOR OIL FIRING



FOR GAS FIRING



FOR GAS-OIL FIRING

A large percentage of present users have ordered additional *Powermaster* units . . . and the list of new *Powermaster* users is getting longer every day.

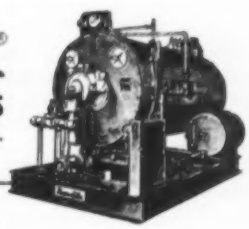
HERE'S WHY— Ease and economy of installation—space-saving compactness—fuel-saving smokeless VORIFLOW combustion—highly efficient operation at all loads—maintenance-saving accessibility—forced draft—full-range automatic modulating firing control—completely automatic operating and safety controls—these are some of the reasons for the steadily growing universal preference for *Powermaster.*

If selecting, installing, or operating boilers is your business, you'll want the complete story of Powermaster cost-saving advantages contained in this new bulletin.

Powermaster®

PACKAGED AUTOMATIC BOILERS

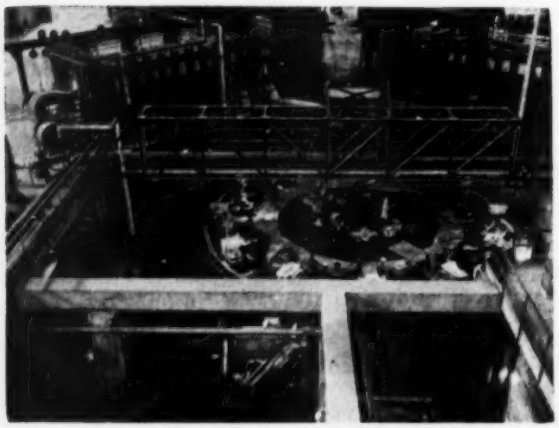
In sizes to 500 HP; pressures to 250 psi.



ORR & SEMBOWER, INC. • Established 1885 • **950 Morgantown Road, Reading, Penna.**

spot news

. . . what's happening in U. S. industrial plants



New Furnaces Produce Larger Copper Cakes

Copper slabs weighing from 1800 to 3000 lb are expected to roll out at the rate of several hundred thousand pounds a day from each of two new furnaces at Raritan Copper Works of International Smelting and Refining Co., a subsidiary of Anaconda Copper Mining Co. These larger pieces as compared to a maximum of 840 lb for cakes formerly produced, make it possible for American Brass Co., another Anaconda subsidiary, to run longer coils of sheet.

Molds, with 90 in. stroke draw-cut shapers, produce parallel-sided cakes which require less handling at the fabricating mill. One molded cake is taken off the casting wheel as another is being poured. Because of the tremendous weights involved, a special take-off device was developed to lower the cake from the mold and carry it up to the main floor for inspection.

In addition to the two new furnaces, there are three anode furnaces, three refining furnaces, and four billet furnaces for casting. When more ore is availabie, the Raritan Copper Works can turn out 50 million pounds of refined copper castings a month, a substantial portion of which will be produced at the new installation.

Boston Will Be Host To Material Handling Clinic

The second in a series of Traveling Clinics on material handling, scheduled for 1953 by The Material Handling Institute, will convene October 2 at the Sheraton-Plaza Hotel in Boston in cooperation with the New England Chapter of the American Material Handling Society.

The purpose of the clinics according to C. B. Elledge of the General Electric Co., chairman of the MHI-AMHS Cooperation Committee, is to develop among users a better understanding of the correct application of material handling equipment to industry's problems.

Five panel discussions, held concurrently, will each cover a general problem such as receiving and shipping, and multi-storied building. Every panel will have a specialist in each general type of material handling activity. For example, one man on each panel will be prepared to advise on the proper use of industrial gasoline and electric trucks, powered hand trucks, storage batteries and accessories. Another will discuss overhead and monorail cranes and hoists, and a third specialist will describe the use of conveyors.

Hydrogen Blisters in Steel Filmed by Radiography

Radioactive isotopes scored again for industry when Iridium 192 was used to film hydrogen blisters in the steel of a refinery reactor unit at the Eastern States Petroleum Co. in Houston, Texas.

Radiation from five ½-in. long capsules, loaded into a special camera-like device, was used to penetrate a wall of 2⅜ in. steel, 5 in. concrete, and ⅛ in. chrome steel liner. As shown in the illustration, sheets of film were taped around the 20 ft high, 51½ ft dia tank. After exposure, the film was developed in a mobile laboratory. The job, accomplished in a single shot taking 8 hours, used a charge of 76,000 millicuries of the gamma source, the largest single industrial collection of such material in the United States.

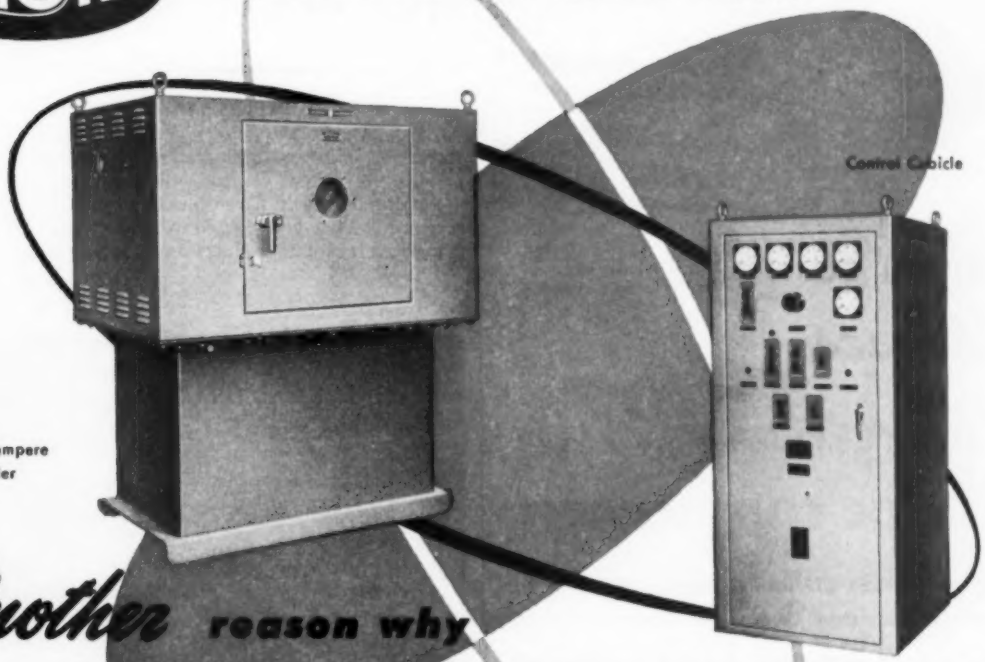
Each man working on the Isotope Products, Inc. project was protected by a docimeter—a device which measures the amount of radiation to which a man has been exposed.

Recognizing the increasing use of radioactive isotopes in industry, Technical Operations, 6 Schouler Ct., Arlington, Mass., will offer, this fall, the first in a series of two-week training programs covering the practical and theoretical

(Continued on page 102)

AEROTEC

electronic Kenotron power supply...



Another reason why

AEROTEC ELECTRICAL PRECIPITATORS

require less maintenance

Aerotec Electrical Precipitators provide long uninterrupted service and require *minimum maintenance*. One reason for this is the exclusive electronic power supply developed for Aerotec Electrical Precipitators which provide these advantages:

1. Complete package unit eliminates field installation problems, cage enclosures and ventilating systems.
2. Control cubicle may be placed on boiler operating floor while rectifier is mounted adjacent to the precipitator.
3. Instantaneous overload protection safeguards Kenotron tubes assuring long life.
4. Electronic power supply eliminates noise, noxious and toxic gases commonly associated with mechanical types.
5. No moving parts; nothing to wear, nothing to lubricate.
6. Rugged constant current network control eliminates operator attention.
7. Rectifier available in weatherproof cubicle for outdoor installation.

In addition to more efficient power supply, Aerotec Electrical Precipitators offer higher collection efficiency by:

- Pocket-type collecting electrodes that prevent dust reentrainment.
- Exclusive high voltage flat plate provides a field of uniform high intensity for maximum precipitation.
- Electromagnetic rappers of low intensity impact clear electrodes of deposit on a continuous short interval basis.

For additional data on Aerotec Electrical Precipitators write or call our project engineers—

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

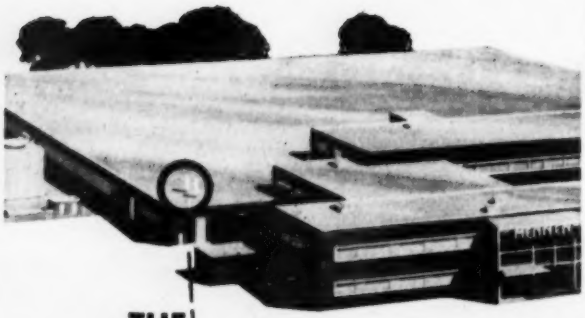
(Offices in 38 Principal Cities)

Canadian Affiliates: **T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 5, Ontario**

Manufacturers

THE AEROTEC CORPORATION

GREENWICH, CONN.



THE MENNEN CO.

A. M. KINNEY, INC.
Architects & Consulting Engineers
Cincinnati, Ohio

Chooses

CYCLOTHERM*

CYCLONIC COMBUSTION

TO SOLVE A COMPLEX STEAM PROBLEM

The Mennen Company chose for their new ultra-modern plant and general office building in Morris Township, N. J., two 350 h.p. Cyclotherm Steam Generators to provide dependable steam for three separate and vitally important factors in their plant operation.

1. FOR PRODUCT PROCESSING

Constant steam is required for production in processing the many Mennen products. Cyclotherm has proven its reliability in thousands of installations throughout the world where steam loads vary, maintaining its high rate of efficiency and low rate of fuel consumption.

2. FOR AIR CONDITIONING

The Cyclotherm Steam Generators will provide 6,840 lbs. of steam per hour required to run two 180 ton absorption refrigeration units for Mennen's unique air conditioning system.

3. FOR PLANT AND OFFICE HEATING

To provide efficient heating for the 264,000 sq. ft. of plant and office space, Cyclotherm was again the first choice.

FIND OUT HOW Cyclotherm Steam or Hot Water Generators can give you: Guaranteed minimum efficiency of 80%; Full power from a cold start in 15 to 20 minutes; Increased savings on fuel and maintenance and many other advantages that are essential in your complex steam problem.

*Reg. trade name

WRITE TODAY for your copy of "All Your Questions Are Answered by Cyclotherm." Just drop a card to Cyclotherm, Dept. 38, Oswego, N.Y.

CYCLOTHERM STEAM GENERATORS

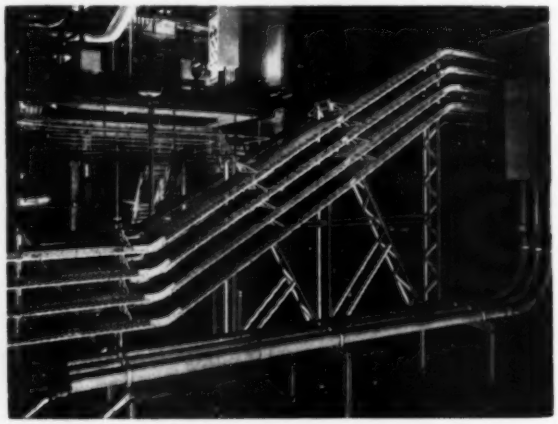
CYCLOTHERM DIVISION UNITED STATES RADIATOR CORP.—OSWEGO, NEW YORK

spot news

(Continued from page 100)

aspects of industrial radiography. Health physics and the handling of gamma sources will be included.

Applicants should have previous technical training or experience in some field related to foundry practice, steel fabrication, mechanical engineering or radiography.



Nut and Bolt Assembly Used for Conduit Runs

Simple nut and bolt construction was used in the installation of miles of complex and heavy conduit, cable, and tubing runs at the Pacific Gas & Electric Company's new Moss Landing, Calif., generating station.

The system of electrical and mechanical supports, supplied by Unistrut Products Co., consisted of steel channel and fittings, tubing, conduit and cable clamps, concrete inserts, and other standard parts which were easily assembled and erected on the job. In addition to realizing savings in engineering detailing, adjustments were made quickly as the work progressed, and changes can be made easily at any time after the work is completed. Also, assembly by the nut and bolt method eliminated drilling and welding.

Natural Gasoline Plant Under Construction

Looking forward to future oil field developments, a natural gasoline plant in New Mexico has been designed for potential doubling of its capacity by the installation of additional compressors and a few minor equipment changes. Fluor Corp., Ltd. is constructing the plant for the Warren Petroleum Corp. Completion is scheduled for February, 1954.

Located near Lovington, the new installation will handle approximately 22 million cu ft of gas daily, with an average production of 30,000 gal of natural gasoline,

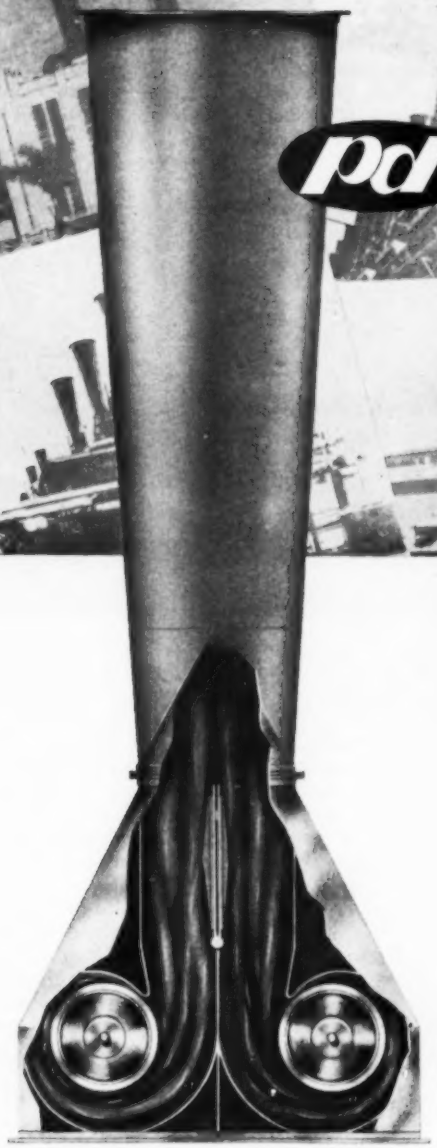
(Continued on page 104)

pd Stacks

for many of America's

most efficient

Power Plants



The wheels of industry move on *power*—generated by power plants that must produce economically, be trouble-free and operate for long periods with a minimum of maintenance.

Efficiency of the boiler is vital . . . stacks must insure this efficiency with a minimum of heat loss, must guarantee predetermined draft production, must assure correct static pressure at all times.

Stack efficiency often means boiler efficiency. That's why many of America's most efficient power plants are Prat-Daniel equipped.

These power plants specified P-D Stacks because:
1. Breeching, fan and stack are built as *one* unit.
2. Losses due to breeching bends are eliminated.
3. Predetermined draft production can be guaranteed.
4. P-D stacks are designed to fit specific power needs.

In the design illustrated, for example, two fans are utilized for widely fluctuating loads. Each fan handles approximately 70% of total volume. Second fan may be automatically cut in. The one stack may be used on two boilers.

Our project engineers—The Thermix Corporation—are experts in fan-stack and flyash collection applications. Consult them for the answer to your draft problems. Ask them for the Prat-Daniel Fan Stack Catalog.

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Quebec; Toronto 5, Ontario

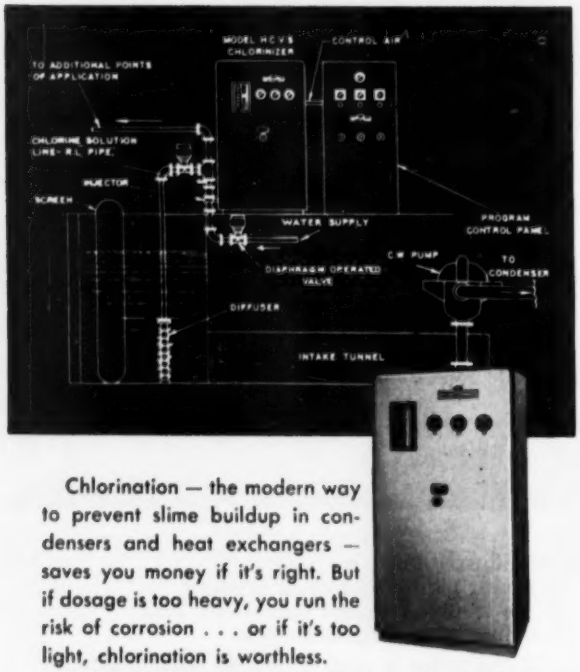
Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks.

Slime Control
IN COOLING SYSTEMS



Chlorination — the modern way to prevent slime buildup in condensers and heat exchangers — saves you money if it's right. But if dosage is too heavy, you run the risk of corrosion . . . or if it's too light, chlorination is worthless.

Builders Chlorinizer is the key to safe, effective, economical chlorination in cooling systems. CHLORINIZER IS ACCURATE . . . The sensitive compensating valve and the visible-flow Sightflo Indicator guarantee correct feed for effective treatment and insure against corrosion. CHLORINIZER IS SAFE . . . The full vacuum principle automatically and positively shuts off chlorine feed on loss of vacuum. CHLORINIZER IS SIMPLE . . . Because of its basic design, Chlorinizer is readily adaptable to single or multiple point applications on manual, semi-automatic, or fully automatic control.

Builders Chlorinizers are available in three volumetric models for feeding from a few pounds to 6,000 pounds per day. Send coupon for complete details.

BUILDERS-PROVIDENCE, INC.

BIF INDUSTRIES (DIVISION OF B-I-F INDUSTRIES) BUILDERS

357 Harris Avenue, Providence 1, Rhode Island

Please send Application Memo No. 840-J9 describing Chlorinizer slime control system.

Name.....

Company.....

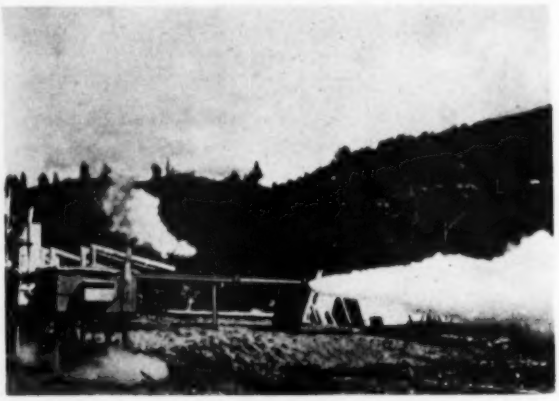
Street.....

City..... State.....

spot news

(Continued from page 102)

15,000 gal of butanes, and 31,000 gal of propane. The mixture will be pumped through a 35 mile pipeline to the company's Monument, N. M. plant for final separation and processing. About 16 million cu ft of residue gas will be delivered to a pipeline network.



Oil Well Rigs Used To Drill for Steam

Government engineers of New Zealand, striving to increase the Commonwealth's present inadequate supply of electric power and also possibly to facilitate the low-cost production of atomic energy, are using oil well drilling equipment in an attempt to tap veins of live steam in underground zones of thermal activity proven to exist on the North Island.

The immediate plan is to bring the steam to the surface in quantities sufficient to operate turbo-generators for the production of electrical current. But the ace in the hole, which may bring new prosperity to the country, is the possibility that the steam may also be useful in the production of "heavy water." Used in the operation of atomic reactors, heavy water is a commodity which has sold for as high as $200,000 per ton.

Pools of boiling mud, geysers and other surface manifestations in New Zealand have long indicated the presence of underground thermal activity. Deep exploratory bores have delivered 94 percent dry steam per hour.

It is now planned to put down bores to a depth of 5000 ft, if necessary, despite the high pressures that may be encountered. To do this, the government has selected two Ideal drilling rigs and four mud pumps manufactured by the National Supply Co. General Motors Series 71 diesel engines with torque converters will power the units.

Although similar rigs are currently drilling oil wells to depths of over 10,000 ft in the United States, the New Zealand operation with bores averaging 12 to 14 inches in diameter, will undoubtedly prove to be a difficult test for the equipment and a somewhat dangerous assignment for personnel. Steam conditions of more than 200 psi and over 400 F are anticipated as drilling progresses.

(Continued on page 138)

a teaspoonful of steam!

HERE'S THE ANSWER TO YOUR SMALL FLOW CONTROL PROBLEMS

a NEW LESLIE REDUCING VALVE

for accurate, foolproof regulation of small flows of steam, air, gas or liquids, with inlet pressures to 1000 psi and reduced pressures from 2 to 400 psi.

Change operating conditions quickly and easily with simple, handwheel adjustment —no need to waste time changing springs or swapping parts. Check these widely accepted Leslie features that are standard in the new, efficient, Leslie Small Flow Reducing Valve.

Check these features

- Simple, compact construction
- Top quality materials
- Metal Diaphragm
- Entirely enclosed—no stuffing boxes
- Corrosion resistant springs
- Hardened stainless steel valve
- Interchangeable inner valves

SEND FOR DESCRIPTIVE BULLETIN 511-A WITH *COMPLETE* CAPACITY TABLES

Before you order—

The new Class LCB is just one of the many units that are ***special*** with most manufacturers but are ***standard*** with Leslie.

Check to see if any pressure, temperature or level control you want is standard with Leslie, before you order. Play it safe. Your Leslie Engineer is listed under "Valves" or "Regulators" in the classified telephone directory in principal cities.

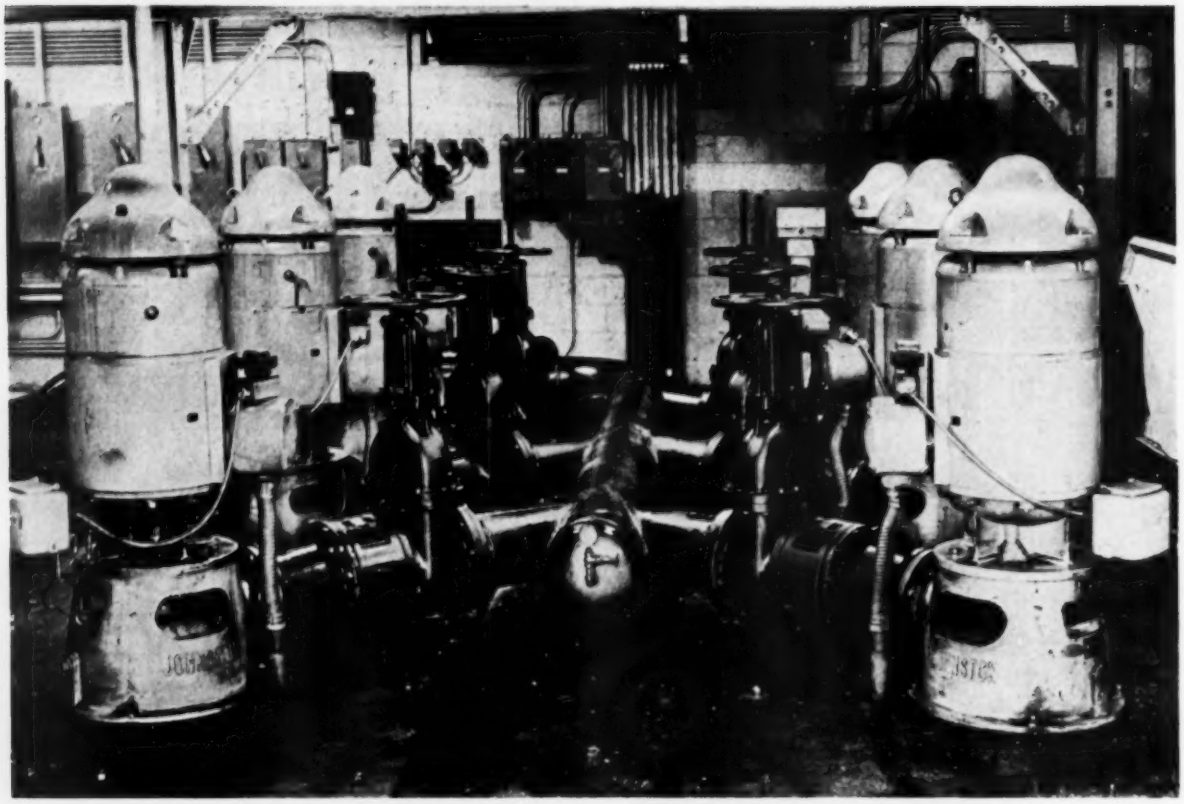
LESLIE

THE FIRST NAME IN PRESSURE, TEMPERATURE AND LEVEL CONTROLS

Since 1900

LESLIE CO., 263 Grant Avenue, Lyndhurst, New Jersey

In small plants and large...



JOHNSTON VERTICAL TURBINE PUMPS ARE HANDLING CRITICAL JOBS IN MANY INDUSTRIES

For example, take the six Johnston Close-Coupled Pumps shown here which are installed at the Gear and Axle Division of one of the BIG THREE auto manufacturers.

Each of these units is pumping cutting oil with a specific gravity of .833—with a viscosity rating of 85 S.S.U. at 100 degrees Fahrenheit . . . and they are doing it at the rate of 2,000 gallons per minute against a 100 foot head. Rated at 60 H.P., these are 2-stage, 14 inch pumps equipped with cast iron semi-open impellers and cast iron bowls. Both bowls and impellers are coated with vitriform porcelain enamel.

This is just another typical example of the ability of Johnston equipment to handle all types of pumping jobs in plant operations, large or small. Why not let our trained engineering staff consult with you on the best solution to YOUR particular problem?

Send today for your free copy of our new bulletin describing Johnston Close-Coupled, Vertical Turbine Pumps designed for industrial service. Ask for Bulletin H-93.

JOHNSTON VERTICAL PUMPS

JOHNSTON PUMP COMPANY

3272 E. FOOTHILL BLVD., PASADENA 8, CALIFORNIA

STOWE Stokers

9 units installed under existing boilers

at U. S. STEEL'S Clairton Works

reduce smoke and fly ash

help make a cleaner, better Allegheny County

● **U. S. STEEL** is justly proud of the contribution it is making in its program of reducing smoke and fly ash in this area. And we, of The Johnston & Jennings Co., are proud of the performance of the 9 Stowe Stokers recently installed in the Clairton Works.

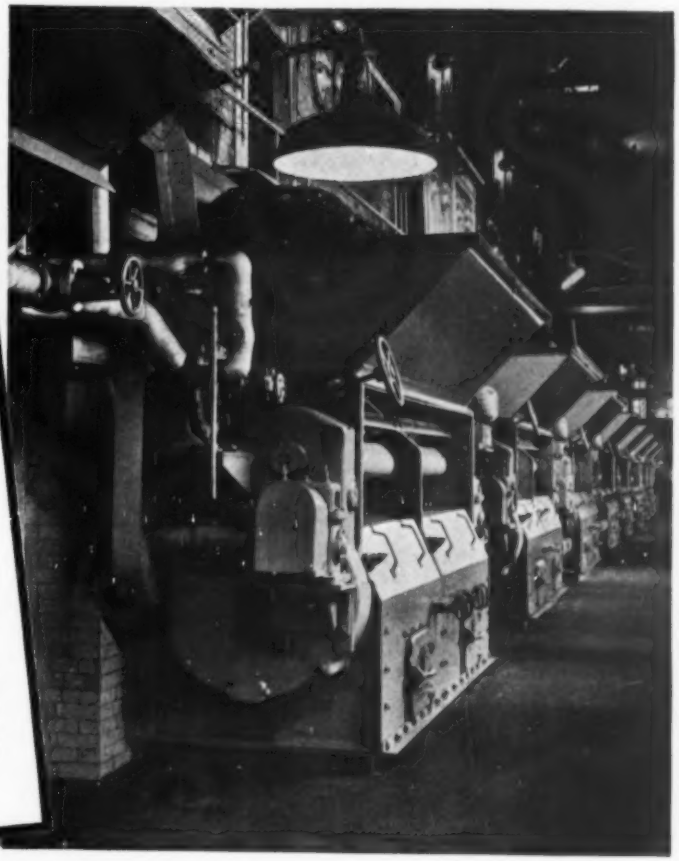
THESE 9 STOWE STOKERS, each installed under an existing boiler, reduced a smoke and fly ash problem. Stacks of these same boilers are now conforming fully to the requirements of the Allegheny County Smoke Control Ordinance — without requiring the installation of any smoke or fly ash collectors.

PRODUCE MORE STEAM

The Stowe Stokers increased the output of the 9 boilers from a maximum of 16,000 to 18,000 lbs. per hour each to 40,000 lbs. per hour each — more than double — and at the same time effected a very material cut in steam costs.

PROVEN DESIGN

Correct burning rates per sq. foot of grate area; — even depth of fuel bed from side to side and front to rear; — and uniform air distribution — no suspension burning — are some of the reasons Stowe Stokers perform so well. Send for Bulletin No. 501. Let us help **you** eliminate smoke, increase the steam output of existing boilers, and cut steam costs in **your** plant.



"More Power to You" with **STOWE Stokers**

Manufactured by **THE JOHNSTON & JENNINGS CO. • 6917 Bessemer Avenue • Cleveland 27, Ohio**

.... *Division of* PETTIBONE MULLIKEN CORP...

HILCO

LUBE and FUEL OIL PURIFICATION . . .

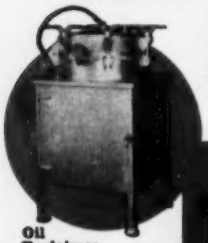
GET RID OF DIRTY OIL . . .
GET LOWER OPERATING COSTS
LONGER EQUIPMENT LIFE

HILCO oil purification means complete oil purification! With a HILCO you get removal of sludge, acids, carbon, water and fuel dilution economically and efficiently. HILCO operation is continuous, all-electric and automatic.

Clean oil at all times reduces down time, increases production and HILCO units pay for themselves in savings.

HILCO offers a wide range of oil purification units . . . one to meet your needs. Write us about your equipment . . . and get recommendations at no obligation.

● *THERE'S A* **HILCO** *FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM*



HILCO has 25 years experience in oil purification. Let this experience work for you.

Oil Reclaimer

Filter

PURIFIERS
FILTERS
RECLAIMERS
CONDITIONERS

A complete range of sizes and systems for oil purification.

★ *WRITE FOR* **FREE** *LITERATURE NO OBLIGATION ON YOUR PART*

THE HILLIARD CORPORATION
105 W. FOURTH ST.
ELMIRA, N. Y.

IN CANADA — UPTON-BRADEEN-JAMES, Ltd.
990 Bay St., Toronto, 3464 Park Ave., Montreal

new bulletins

. . . catalogs from leading manufacturers

AIR FILTERS & DUST COLLECTORS

200—Dust Collectors

Photographs of typical plant installations of hydro-foam dust collectors and fog filters are presented in 12-page bulletin A-654. Special applications for each type are presented in addition to cross-section diagrams which explain the operation of the units. Finishing systems such as spray, dip, and flow coating are also described. R. C. Mahon Co.

FILTERS, STRAINERS, & PURIFIERS

201—Industrial Filters

Essential features and applications of ten basic types of industrial filtration equipment are presented in 8-page bulletin A-943. Disc, cartridge, and pressure filters, flotation units, vacuum stills, magnetic separators, and oil conditioners are discussed. The booklet also lists available bulletins describing each specific unit. U. S. Hoffman Machinery Corp., Industrial Filtration Div.

202—Internal Downflow Purifiers

Featured in 4-page bulletin 401 are two pages of selection tables designed to aid in selecting the proper purifier for any steam, air, gas, or vapor installation. Typical examples and solutions show how the tables are used. Operation and advantages of internal downflow purifiers for steam drums, flash tanks, evaporators, pack towers, deodorizers, stills, bubble-cap towers, and receivers are described. Dimensions, weights, and specifications are tabulated. The V. D. Anderson Co.

PRODUCT INDEX

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Engines & Turbines	116
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Heat Exchanger Equipment	108
Heating, Air Conditioning, & Refrigeration	120
Instruments & Controls	112
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Pumps & Compressors	118
Valves & Regulators	108
Water Treatment & Waste Disposal	112
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Bulletins You May Have Missed	120

HEAT EXCHANGER EQUIPMENT

203—Heat Exchanger Calculator

Providing all necessary data for the selection of shell and tube type heat exchangers, manufactured by this company, is a handy 2-color calculator designed like a slide rule. The calculator is used to determine the square feet of surface necessary to transfer a given amount of heat between oil or water on the shell side, and water on the tube side. Simple operating instructions and tables of tube surface areas are included. Young Radiator Co.

VALVES & REGULATORS

204—Cushioned Valves

Valves which can be used to replace either troublesome gate valves requiring frequent manual operation, or in place of diaphragm valves, are described in 4-page folder W-8. They can be used for water, oil, air, and other liquids at pressures from 15 to 400 psi. Design and construction features, a complete parts list, and tables of dimensions and specifications are given. Golden-Anderson Valve Specialty Co.

205—Welded Floats

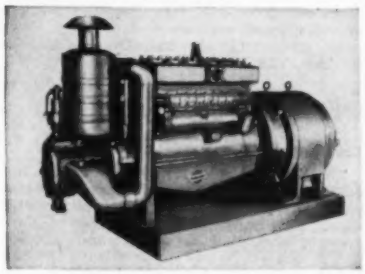
Welded floats of stainless steel, monel, and chrome plated steel in spherical, eliptical, and cylinderical shapes are presented in 8-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4800 psi are listed. Application and construction data are presented. Weights, buoyancies, and collapsing pressures are given. W. H. Nicholson & Co.

(Continued on page 110)

NOTE — Each item has a key number for your convenience in asking for a free, personal copy. Insert key numbers on return post card found on page 123.

NEW SUPER-*Unistage* Air Compressor Offers Many Advantages

Schramm, Inc., makers of air compressors for 54 years, announces the newest in its line — a 600 c.f.m. industrial model, the Super-*Unistage*. Major advantage of this compact, vibrationless unit is its super-charge design, which puts it in a class all by itself and answers the industry's demand for such a model.



Noteworthy advantages are offered by the Super-*Unistage*. For here has been designed a large capacity compressor which at the same time is compact, vibrationless, adaptable to the unit-system installation whereby multiple power can be provided by operating the series of units, or a single or several units when peak air loads are not required.

Tailor-Made for Economy, Larger Air Capacity

Before purchasing any air compressor, it is quite natural to investigate its purchase price, maintenance, upkeep and installation costs. Here, in one package, you have the answer to your search for economy.

Its price is in keeping with the air it supplies . . . there is practically no installation cost since no elaborate foundation is required . . . and its maintenance is low.

Features

The Schramm Super-*Unistage* is a 150 h.p. six cylinder model having mechanically operated intake valves with the patented Schramm intake valve unloaders, large diameter cushioned low lift discharge valves, seven main bearing crankshaft with pressure lubrication to all bearings.

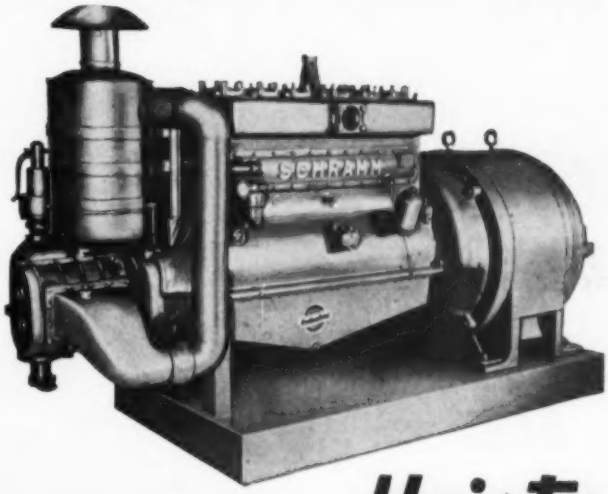
The unit is available with either an intercooler of a tubular type heat exchanger, with the water passing from the intercooler through the compressor jackets (as shown in illustration) or with the Schramm cooling unit, radiator type, in which the intercooler is an air-cooled unit with fan.

The model illustrated has 440 volt, 3 phase, 60 cycle, low starting current, normal torque, induction motor. Also, 208, 220 or 550 volt induction motors are available at the same price.

Other features make the unit notable.

SCHRAMM, INC., THE COMPRESSOR PEOPLE, WEST CHESTER, PENNA.

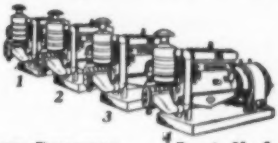
Here It Is . . .
The Air Compressor You Asked for



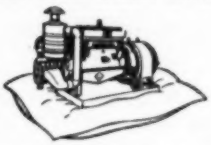
SCHRAMM SUPER-*Unistage*

A Super-Charged 600 c.f.m. Air Compressor Designed to meet your Compressor needs for . . .

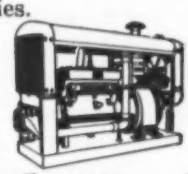
COMPACTNESS . . . requires less floor space than other models.



UNIT SYSTEM . . . Installed as a series, provides air as the air need varies.



VIBRATIONLESS . . . Perfect balance of all moving parts.



COMPLETE PACKAGE . . . No extras — everything one unit!

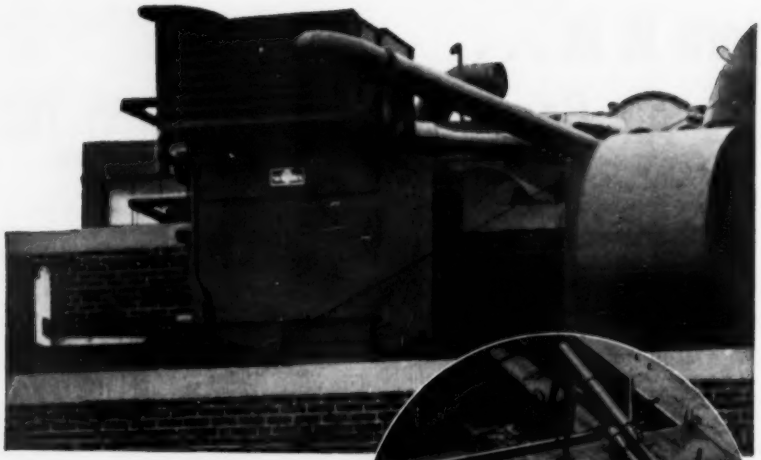
NO ELABORATE FOUNDATION . . . sturdy floor needed — that's all!

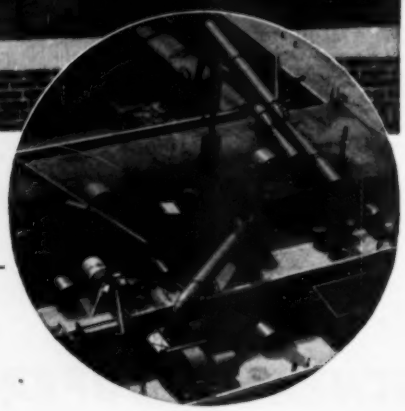
EASY TO MOVE . . . air where you need it — and want *it!*

Get full details on this new, exciting 600 c.f.m. air compressor today. Bulletin 5313 is now available. Write for your free copy.

SCHRAMM, INC.

The Compressor People • WEST CHESTER • PENNSYLVANIA





DRY, FRESH ---------AIR---------- For a Supersonic WIND TUNNEL

● New and improved, this NIAGARA METHOD that effectively dries outdoor air for a wind tunnel used for testing at supersonic speed, can be trusted to give you the best air conditions for your purpose:

- **to dry your materials or products**
- **to prevent condensation or moisture damage**
- **to protect your moisture-sensitive processes**
- **to give you an atmosphere in which your product can be packaged or stored safely.**
- **to give you exactly the right atmospheric conditions for testing materials**
- **to put "fresh air" back into your air conditioning, increasing its capacity and effectiveness**

The Niagara "fresh air" Method removes the excess moisture from outdoor air by contact with an absorbent liquid in a spray chamber. The liquid contact temperature and the absorbent concentration, both controlled thermostatically, determine the amount of moisture in the conditioned air. Heating or cooling the air is a separate function. Therefore, you can easily and inexpensively have a precisely controlled condition without the use of moisture sensitive instruments.

The Niagara Absorbent Spray Method is noted for solving the really difficult problems of air conditioning. Write for complete information.

NIAGARA BLOWER COMPANY

Over 35 Years' Service in Industrial Air Engineering

Dept. IP, 405 Lexington Ave. **New York 17, N. Y.**

Field Engineers in Principal Cities of U. S. and Canada

new bulletins

(Continued from page 108)

206—Valves

Steel, iron, and bronze valves, as well as lubricating devices, boiler mountings, cocks, and other products, are described in a 506-page catalog. Over 100 pages of reference data are provided. A handy, illustrated, thumb-indexed selector guide groups valves according to pressure classifications to enable the engineer to find specifications, reference data, and code requirements for any valve in a matter of seconds. The Lunkenheimer Co.

ELECTRICAL EQUIPMENT

207—Wire and Cable

"Wire and Cable for the Chemical Industries," a 19-page booklet, discusses the various types of cable that best withstand the moisture and corrosive conditions, chemical exposure, and atmospheric contamination present in chemical plants. Full specification data, product photographs, and actual installation illustrations are included. Electrical engineers in chemical plants should find this bulletin useful. Construction Materials Div., General Electric Co.

208—Dry-Type Transformers

Savings possible by the use of totally-enclosed, Type E, non-ventilated dry-type transformers are outlined in 8-page bulletin B-5812. Features of the unit such as Hipersil cores, class H insulation, accessible terminals, and totally-enclosed construction are illustrated and discussed. Westinghouse Electric Corp.

209—Circuit Breaker Actuator

Advantages of an hydraulic actuator for power circuit breakers are outlined in folder 71B7942. Component parts are illustrated and described. Line drawings show position of the parts during the closing stroke and at reset. A rating table and typical speed graphs are included. Allis-Chalmers Manufacturing Co.

210—Gear Motors

Squirrel-cage, wound-rotor, and d-c motors 1 to 150 hp are pictured and briefly described in 4-page folder PB 18000-1. A cross-section drawing shows salient features of the motor and also explains the advantages of each. Various gearcase positions for single, double, and triple reduction types are shown, and enclosures to meet specific conditions are presented. Elliott Co., Crocker-Wheeler Div.

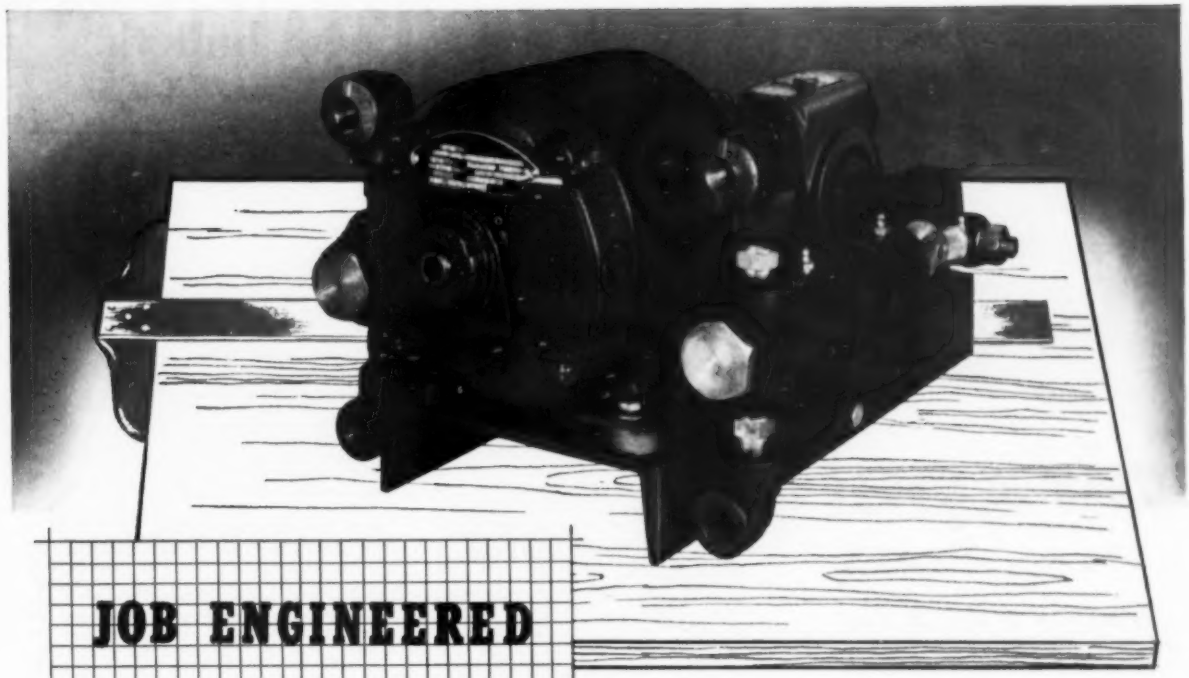
211—D-c Motors and Generators

Details of d-c motors from ½ to 300 hp, including mechanical construction, available enclosures, applications, and special d-c designs are illustrated by photographs and cutaway drawings in 16-page bulletin 1450. Also included is motor-starting information, adjustable speed applications, and a section on motor-generator sets for converting ac to dc in industrial service. Louis Allis Co.

212—Lighting Standards

RLM standard specifications for industrial lighting units are presented in a revised, 52-page manual. Additions and revisions include specifications for semi-direct fluorescent lighting units, clarification of existing standards, and tables of

(Continued on page 112)



JOB ENGINEERED

H-20 PUMP FOR DEPENDABLE LOW-COST SERVICE

For water treating services, and other applications that do not need the extremely high accuracy of Step-Valve liquid ends, Milton Roy offers the performance-proved H-20 Controlled Volume Pump.

This rugged pump has already gained wide acceptance in a variety of applications . . . in water treating installations, dry cleaning plants, bottling works . . . and as components of packaged steam boilers.

CAPACITIES: 3 to 12 gallons per hour in standard models.
MODELS: Simplex or Duplex (illustrated).
DISCHARGE PRESSURES: To 600 pounds per square inch.
MATERIALS OF CONSTRUCTION: Cast Iron and Stainless Steel.
PRICE: As low as $174.00 for cast iron construction, stainless steel trim, 300 psi discharge pressure, 6 gallons per hour maximum, ⅓ hp motor, single phase, 60 cycles, 115 volts, open.

Truly job-engineered, this dependable, low-cost H-20 pump includes such design features as double ball-checks on suction and discharge . . . spring-loaded packing that insures proper tension . . . construction for mounting any standard NEMA frame ¼ hp or ⅓ hp motor . . . simplicity in converting to duplex model.

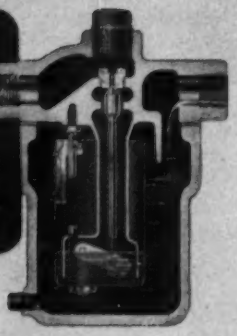
H-20 is the latest product of Milton Roy . . . manufacturing engineers of controlled volume pumps and complete chemical feed systems for all industry.

For complete illustrated technical data, write *today* for *new free Bulletin H20M.*

MILTON Roy COMPANY
Manufacturing Engineers 1319 E. MERMAID LANE • PHILA. 18, PA.
CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS

Reliability

DESIGNS THAT REPRESENT 50 YEARS TRAP BUILDING EXPERIENCE



"airxpel"

STEAM TRAPS

Remove Both Air and Condensate

"CUB" TYPE
½" to 1½"
to 250 PSIG

"MASTER" TYPE
½" to 2"
to 300 PSIG

"Y" STRAINERS
2" to 8" (flanged)
½" to 3" (threaded)

FORGED STEEL
½" to 1¼"
to 600 PSIG

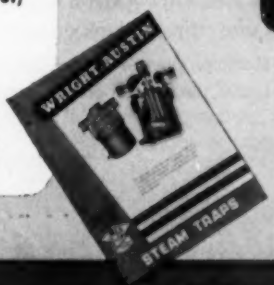
This equipment offers design advantages that represent long experience in building steam saving devices for industry.

Orifices of Wright-Austin traps can be interchanged without disassembling the trap. Connections are the straight-through type. Both of these features contribute to speed and ease of installation.

Wright-Austin traps are available for lines ½" to 3", for pressures up to 600 P.S.I.G. and with capacities up to 65,025 pounds of water per hour.

For complete information on traps and other accessories that you can stock to advantage and depend on for efficiency that means low cost, write, today, for:

Trap Catalog #600
Separator Catalog #500
Boiler Trim Catalog #700



WA Standard STEAM USERS SINCE '94

WRIGHT-AUSTIN
COMPANY
3245 WIGHT STREET • DETROIT 7, MICH.

new bulletins

(Continued from page 110)

typical coefficients of utilization and light distribution curves. Lighting specialists, architects, and electrical contractors will find this booklet a useful reference tool. RLM Standards Institute, Inc.

INSTRUMENTS & CONTROLS

213—Metering Pumps

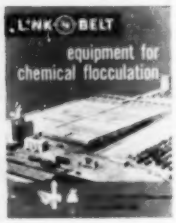
Pumps for small manufacturers, pilot plants, and research, as well as for processing small quantities of valuable fluids, are the subject of two bulletins, H2OM and 653. Materials of construction, capacities, and design features are given, as well as a list of related technical papers and bulletins. Milton Roy Co.

214—Portable pH Meters

Prepared to simplify the choice of pH equipment, 4-page folder 322-88 describes four types of meters for research studies, routine laboratory control, and portable units for use in the plant or field. Salient performance features such as cost and accuracy are given as well as a list of industries where these instruments are used. Beckman Instruments, Inc.

215—Measuring Devices

Information on more than 115 testing and measuring devices are contained in 64-page catalog GEC-1016A. A brief description of each product and its field of application, condensed tables of important characteristics, and prices indicate whether or not the instrument is suited for a specific job. Products range from simple current indicators to completely automatic oscillographs, and from surface roughness scales to mass spectrometers. General Electric Co.



WATER TREATMENT & WASTE DISPOSAL

216—Chemical Flocculation

Chemical flocculation conveying and mixing equipment for use in water, sewage, and industrial waste treatment plants is described in 8-page booklet 2442. Installation photographs show many types of conveying and elevating equipment for economical handling of bulk or packaged chemicals. Flash and straight line mechanical mixers are described in detail and inserts contain general arrangement drawings and specifications. Tested layouts and selection tables to aid in determining tank size for required circulation flow are included. Link-Belt Co.

217—Package Water Conditioner

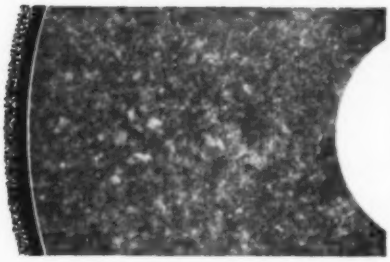
Component parts of a complete water conditioning plant, including principles

(Continued on page 114)

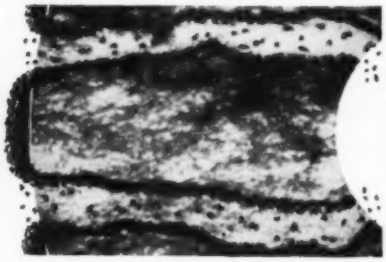
GRADUATED DENSITY

makes MICRO-KLEAN the most effective filter on the market!

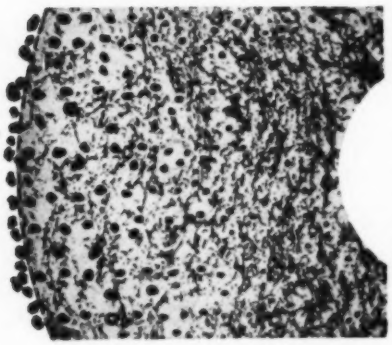
How MICRO-KLEAN compares with other cartridge filters



Compare MICRO-KLEAN with FILTERS WITH THE SAME DENSITY THROUGHOUT. The filter media density is the same on the pressure and discharge surfaces of the element; therefore, dirt accumulation is largely on the outside surface, choking the cartridge ("plastering") and reducing the effective filter life.



Compare MICRO-KLEAN with FILTERS WITH HAPHAZARD DISTRIBUTION OF FILTER MEDIA. Uneven haphazard media density permits fluid to find channels through the filter, and pass solids larger than the minimum filter spacing.



Now Look at the advantages offered by MICRO-KLEAN. See how the fibre density increases toward the discharge side of the MICRO-KLEAN filter cartridge? In effect, every Cuno MICRO-KLEAN cartridge is an infinite multiplicity of screens, ranging from relatively coarse on the outside down to 10 microns in the center. Because of MICRO-KLEAN'S graduated density in depth, particles are entrapped within the entire depth of the filter element, giving the cartridge a much longer effective life. Standard cartridge size is 9¾" long by 2¾" O. D., in densities of 10, 25 and 50 microns.

MICRO-KLEAN gives you

- greater dirt holding capacity
- absolute protection against rupturing or channeling of the cartridge
- longer effective cartridge life

REMEMBER . . . IF YOU CAN PUMP IT, CUNO CAN FILTER IT

M.3.C

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

COMPACT, FULL-FLOW FILTRATION FOR INDUSTRIAL FLUIDS

Fewer Cartridge Changes Necessary with MICRO-KLEAN filters

You don't need a complicated, bulky filter to keep contaminants out of your chemicals, water, lube or fuel oils. Cuno MICRO-KLEAN's compact construction gives you full-flow filtration in space which would limit ordinary filters to by-pass service.

The high porosity and low pressure drop operation of MICRO-KLEAN filters permit this full-flow service on gravity, low pressure, or suction lines—with no loss in operating efficiency.

Cartridge replacement costs are generally cut in half when MICRO-KLEANS are used. MICRO-KLEAN's graduated density-in-depth provides much greater capacity for dirt accumulation within the micronic cartridge, giving twice the useful life of an ordinary filter element.

Cuno's exclusive method of felting fibres produces a cartridge of great structural strength, free from channeling or distortion and entirely unaffected by moisture or acids. And changing cartridges can be accomplished in a few seconds—only one nut has to be removed.

Send for Cuno's free filtration analysis form, have one of your engineers fill it out, and mail it to us. We'll let you know exactly what you need for your filtration requirements—without obligation. And take advantage of Cuno's unique "money-back" offer. If MICRO-KLEAN doesn't outperform any filter cartridge you have previously used, we'll send you *double* your money back. Send the coupon today for free MICRO-KLEAN bulletin. M.3.5

Cuno Engineering Corporation
Dept. 145C South Vine Street, Meriden, Conn.

I'm interested in your "money-back" offer. Please send me your filtration analysis form—and more information on MICRO-KLEAN for

..... (fluid)

Name.....

Company.....

Address.....

City.....Zone....State.....

...Rugged, Efficient, Economical...
Pays for itself Quickly

For continuous and heavy duty service at constant capacity and efficiency, Norblo Automatic Bag Type Dust and Fume collection pays its own way—in the recovery of valuable materials or the removal of injurious or "nuisance" industrial air contaminants. Norblo builds the entire installation, from blowers to bag-cleaning mechanisms. Complete systems are engineered to meet specific situations, production layouts and required capacities. Norblo engineering insures low maintenance and no shut-downs—guarantees performance of every installation. Write for Bulletin 164-3.

Norblo also builds centrifugal and hydraulic dust collectors, exhaust fans, cement air cooling systems and portable dust collectors.

Cutaway shows Norblo basic unit of 78 bags. Automatic shaking and bag cleaning, one unit at a time, insures full use of cloth area better than 99% of the time.

The Northern Blower Company
Engineered Dust Collection Systems for All Industries
6422 Barberton Ave. Cleveland 2, Ohio

new bulletins

(Continued from page 112)

of operation, ratings, capacities, sizes, and illustrations of typical installations, are presented in 8-page booklet 3869. A table lists gallons per hour, flow per day, number of filters and purifiers needed, and sizes of complete units. Permutit Co.

218—Deaerating Heaters

Specific functions and requirements of spray-type deaerating heaters are explained in 8-page bulletin WC-101A. Design features and operation are described, and accessory equipment is outlined. Illustrations include sectional drawings and representative installation photographs of horizontal and vertical designs, together with flow charts of units in typical applications. Graver Water Conditioning Co.

219—Water Softener

Four page bulletin 612 describes the design and operation of an automatic water softener which is equipped with pilot operated, diaphragm-type hydraulic valves. Each stage of operation is fully explained by illustrations and diagrams. Elgin Softener Corp.

TO REQUEST FREE BULLETINS

Insert "key" numbers on return post card found on page 123. Your requests will be handled promptly.

220—Waste Control

Application memo 600-K2 shows by diagram a package waste control system for use in areas where harmful wastes must be fed into the sewage lines at a predetermined rate. Advantages of such a system and the equipment required to meet various conditions are appraised. Builders-Providence, Inc.

BOILERS & BOILER ACCESSORIES

221—Water-Tube Boiler

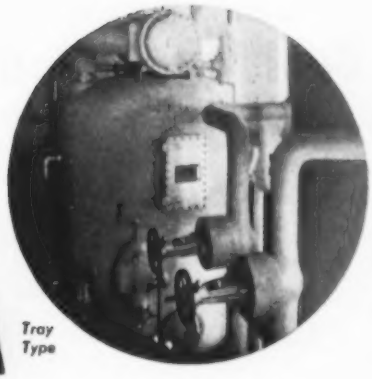
Described in 16-page brochure P-360 is a new packaged water-tube boiler. Following an introduction providing background information is a section outlining principal design features of the units which are completely shop assembled and provide steam capacities from 4000 to 30,000 lb per hr. Design pressure is listed at 250 psi. Space requirements are shown in a table, along with typical specifications. A concluding section describes the automatic control system. Combustion Engineering, Inc.

222—Packaged Boilers

Packaged automatic boilers for light oil, heavy oil, gas, or combination gas and oil firing are featured in 16-page bulletin 1219. Design and construction details are pointed out in a large cutaway view. Factors contributing to long life and outstanding service are appraised. Ratings from 15 to 500 hp are listed in tables of specifications, and actual installations for steam process as well as for steam and hot water service are illustrated and described. Orr & Sembower Inc.

(Continued on page 116)

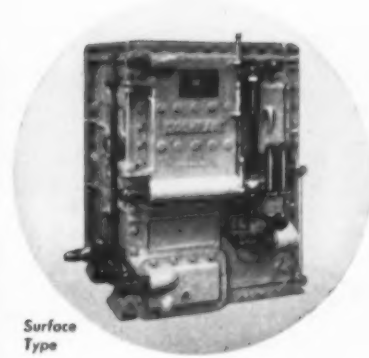
DEAERATOR TYPES FOR ALL SERVICE REQUIREMENTS



Tray Type

Atomizer or Spray Type

Jet Tray Type



Surface Type

HAVE YOU PROBLEMS OF: CORROSION? FEED WATER HEATING? DEAERATION?

Call Cochrane. Whether your plant is large or small, the *unbiased* recommendations of Cochrane Engineers will assure the correct selection of equipment for your particular operating conditions. As specialists in the field of Deaeration, Cochrane originated the jet tray and atomizing principles and designs and manufactures all types of Deaerating equipment—Tray, Jet Tray, Atomizer or Spray, and Surface—in all sizes, all materials.

Over 90 years of specialized experience in water conditioning are at your service when you call a Cochrane Engineer. Write for the address of our office nearest you. We'll be happy to discuss your requirements without obligation.

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corp. 3108 N. 17th Street, Philadelphia 32, Pa.

offices in 29 principal cities

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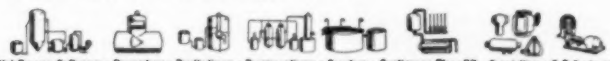
In Mexico: Babcock & Wilcox de Mexico, S. A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris
In Cuba: Laurence E. Daniel, Inc., Havana
In South America: Servicios Electricos, C.A. (S.E.C.A.) Caracas, Venezuela
In Puerto Rico: F. A. Ortiz & Co., San Juan 5



Hot Process Softeners • Deaerators • Dealkalizers • Demineralizers • Reactors • Continuous Blow-Off • Specialties • C-B Systems

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STIC•TITE

INSULATING CEMENT

Easier to Work and Finish

Mix Stic-Tite with water and you get a plastic cement that's easy to work and finish smooth over block or blanket insulation on all types of heating equipment, around pipes, fittings and difficult shapes.

Sticks Tight • Durable

Applied to any required thickness over any clean surface—hot or cold—Stic-Tite quickly drives to an air-tight, strong, resilient, tough covering that stays on. It does not lift off or shake loose, even under vibration, abrasion or impact in normal operation.

Covers Better

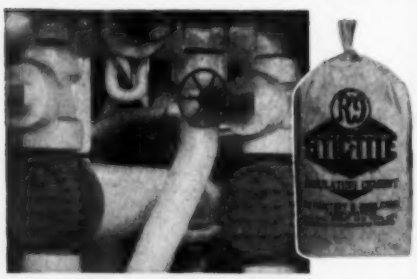
Stic-Tite is truly economical. It covers at least 45 sq. ft., one inch thick, per 100 lbs. of material.

Saves More Heat

Stic-Tite is the most efficient of plastic insulations. Its insulating value is indestructible under practically all service conditions up to 1800° F. Cover those flanges, fittings and other base surfaces with as little as 1½" thickness of Stic-Tite and you save at least 90% of the heat loss.

Easily Reclaimable

Stic-Tite need never be wasted or discarded, even if removed for equipment repairs. Easily crushed and remixed with fresh water, it can be reapplied as before.



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REFRACTORY BONDING AND CASTABLE CEMENTS

INSULATING BLOCK, BLANKETS AND CEMENTS

130 WALL STREET • NEW YORK 5, N. Y.

new bulletins

(Continued from page 114)

223—Boiler-Burner Unit

Oil, gas, or oil and gas combination pressurized boiler-burner units are described and illustrated in a 14-page brochure B-3133. Usable charts of output rating, performance data, and dimensions are included in addition to a cutaway drawing of the unit and a discussion of its various elements. Titusville Iron Works Co. and Iron Fireman Mfg. Co.

224—Water-Tube Steam Generators

Data and specification for factory assembled water-tube steam generators in sizes ranging from 5300 to 33,000 lb per hr are presented in an 8-page brochure. The units, for pressures up to 400 psi, are designed to provide fully automatic firing with oil, gas, or stoker-fired coal. Cutaway views show construction features. Superior Combustion Industries, Inc.

225—Pump Recirculation Control

Control systems for protecting high capacity centrifugal boiler pumps during low load conditions is the subject of 12-page bulletin S-53. Information for determining when recirculation control is needed is included as well as operation and arrangement of electrically and pneumatically operated control systems. Valves and control equipment for each system are also pictured and specifications given. Republic Flow Meters Co.

LUBRICANTS & LUBRICATION EQUIPMENT

226—Force Feed Lubricator

High pressure force feed lubricators, designed for service at pressures to 30,000 psi, are described in 12-page catalog 25G. Tables show output, dimensions, and specifications. Detailed information is given on how to order the correct unit and fittings for your job. Manzel Div., Frontier Industries Inc.

ENGINES & TURBINES

227—Flame Failure Explosions

"Guarding Your Properties Against Flame Failure Explosions," booklet CP21, shows how to determine whether your fuel burner is adequately protected against explosion and briefly describes equipment to provide complete protection. Combustion Control Corp.

228—Gas Turbines

Twelve factors to be considered in selecting a combustion gas turbine power plant for mechanical drive service are listed in 24-page booklet B-5859. Construction and design features, load diagrams, dimensioned outline drawings, and per-

formance curves for four types of turbines are featured. Sample calculations show how to use the curves to determine various engineering data. Also presented are design details of the air compressor rotor and casing, gas turbine rotor and casing, combustion system, auxiliary assembly, control panel, and double helical gears. Westinghouse Electric Corp.

MECHANICAL POWER TRANSMISSION

229—Fluid Drives

Operating principles for variable speed fluid drives are discussed in 24-page bulletin 9319. Component parts, applications, advantages, dimensions, auxiliaries, and controls are discussed. Included in an engineering section are torque charts and a table on speed reduction factors. Hydraulic Coupling Div., American Blower Corp.

230—Industrial V-Belts

V-belts and their applications are discussed in a 60-page engineering catalog. Prepared specifically for engineers, the publication lists the new increased horsepower ratings approved by the Rubber Manufacturers Association. It also contains two new correction factors, namely, length correction and small diameter factor for use in designing a V-belt drive. Revised pre-engineered drive tables simplify calculations. In addition to engineering information on general duty V-belts, sections are devoted to open-end and link-type V-belting. Durkee-Atwood Co.

231—Roller Chain Sprockets

Advantages of sprockets using tapered bushings are appraised in 24-page booklet A-624. Data are provided to aid in selection. Riveted and cottered type roller chains also are described. Of particular value is a section discussing selection of roller chain drives. Included are tables of horsepower ratings, tables on the calculation of chain length and center distance, and discussions on the installation, lubrication, cleaning, and maintenance of roller chain drives. Dodge Manufacturing Corp.

TO REQUEST FREE BULLETINS

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PIPE, TUBING & HOSE

232—Arc Welding Procedures

Data card TDC-155, entitled, "Summary of Recommended Arc Welding Procedures for Various Steel and Croloy Combinations," outlines the pertinent details to be observed in joining similar and dissimilar alloys. It suggests electrodes to be used, as well as preheating and postwelding heat treatments for satisfactory results when fabricating tubular materials. Tubular Products Div., The Babcock & Wilcox Co.

233—Wrought Iron Pipe

Data contained in 4-page bulletin 27a-By includes information most frequently required by engineers concerned with the design and specifications of wrought iron pipe. Suggested applications include special services such as radiant heating and snow melting systems, as well as numerous uses in heating, air conditioning, and

(Continued on page 118)

It will pay you to look into Bird-Archer's 8 Point Water Treatment Service.

1 **PLANT SURVEY—Complete studies of your use of water or steam including equipment and past performance.**

2 **STUDY OF ALL AVAILABLE WATER—Exhaustive analysis of water supplies starting at source.**

3 **LABORATORY SERVICE FOR SCIENTIFIC ANALYSES—Modern laboratory facilities with seasoned chemists specializing in water analyses and research.**

8

ENGINEERING SERVICES FOR WATER TREATMENT

For Power • For Process • For Cooling

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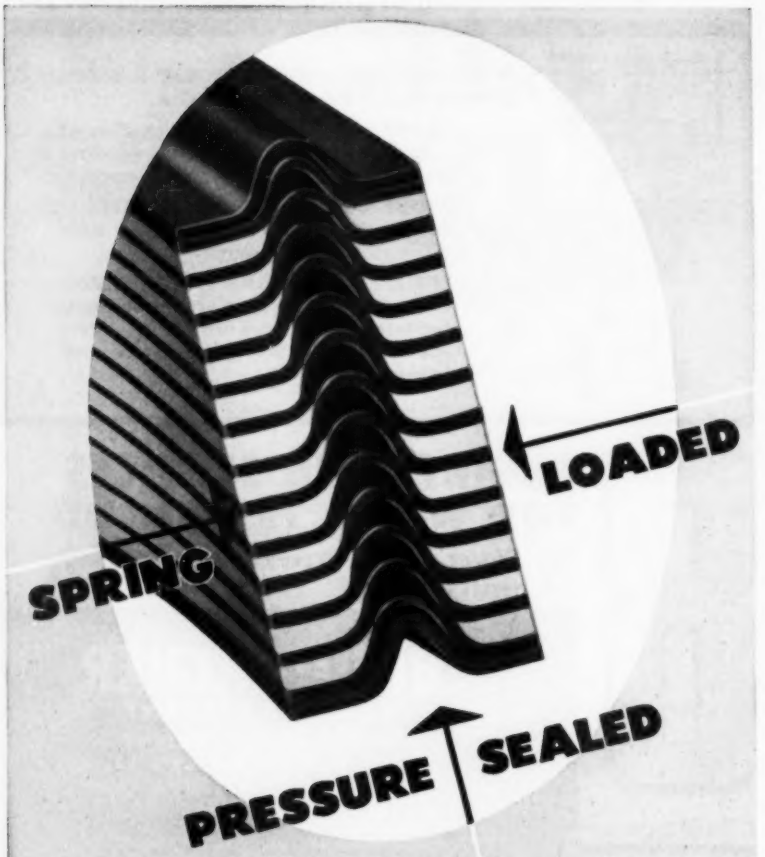
7 **PLANT STAFF INSTRUCTION—Your personnel instructed by experienced technicians in accurate control and test procedures.**

8 **PERIODIC CHECK-UPS—Your Bird-Archer Service Engineer makes regular personal call-backs on your plant to be sure you get the best possible results.**

BA-903

FOR COUNSEL BACKED BY OVER SIXTY YEARS OF EXPERIENCE CALL BIRD-ARCHER'S QUALIFIED WATER TREATMENT ENGINEERS. CONSCIENTIOUS, PERSONAL ATTENTION AND HIGHEST QUALITY CHEMICALS.

Engineering Plus Chemistry Equal BIRD-ARCHER Service



It's the live-spring action and U-shape of the metal plies in Ajax Spiralwound Gaskets that permits them to give and take with varying pipe line or boiler stresses, to seal joints tight at safe bolt loads and utilize the pressures they are sealing against to keep them tight under all operating conditions.

There are types and sizes for all standard flanges and for manholes, handholes and tube caps for all makes of stationary and marine boilers, waterwalls, economizers, etc.

Materials of construction include plated low carbon steel or stainless, Canadian or blue African asbestos or chemically inert duPont Teflon.

Sold universally through industrial distributors. Ask your supply house or write—

UNITED STATES GASKET COMPANY

FABRICATORS OF "TEFLON" & "KEL-F" FOR THE CHEMICAL PROCESS & ELECTRONIC INDUSTRIES
CAMDEN 1 NEW JERSEY

Representatives in Principal Cities Throughout the World

new bulletins

(Continued from page 117)

water supply systems. Of particular interest is a handy radiant heating conversion chart. Consolidated tables list dimensions, threads per in., mill test pressures, length per sq ft of surface area, length per cu ft of volume, and gal per linear ft for standard weight and extra strong pipe. The analysis and physical properties of wrought iron also are tabulated. A. M. Byers Co.

BUILDING MATERIALS & MAINTENANCE

234—Masonry Water Repellent

Discussed in a 4-page folder is an inorganic water repellent designed for brick, concrete, sandstone, stucco, asbestos cement combinations, cement base paints, and other composition surfaces. The bulletin explains how the product eliminates dampness on interior wall surfaces and lists many other advantages. The result of accelerated weathering tests are appraised. Flexrock Co.

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MATERIALS HANDLING EQUIPMENT

235—Roller Chain Wheels

Roller chain wheels with taper bushings are described in 16-page catalogue 2449. Diagrams explain construction and the method of installation. Tables list stock sizes of wheels and bushings. Link-Belt Co.

236—Gates and Valves

Various types of gates and valves for handling bulk materials are briefly described in 20-page catalog 1252. Advantages, applications, construction, and dimensions are presented. In addition to such conventional units as slide and quadrant gates, the booklet presents newly developed units including a double-closure bin valve and a new bin gate. Stephens-Adamson Mfg. Co.

PUMPS & COMPRESSORS

237—Centrifugal Pumps

Six types of end suction, centrifugal pumps with various mountings, frames, and drives are described in 4-page folder W-300-B4. Capacities for each type are shown in graphs, and specific applications are discussed. Worthington Corp., Centrifugal Pump Div.

238—Fire Pumps

Cross-section views with additional descriptions of the design, construction, and performance of horizontal, single-stage and vertical, multi-stage pumps are contained

(Continued on page 120)

AIR CAN BE JUST AS IMPORTANT TO YOU!

When his air supply runs out, the "smoke-eating" fireman is out of business . . . possibly permanently. In a business sense, your plant air supply can be just as important.

Inadequate dust or fume control seriously threatens operating efficiency, employee morale, plant-community relations, profits.

Air is the all-important tool in dust and fume control. The Kirk & Blum organization specializes in putting "clean air . . . the invisible tool" to work in virtually every industry. In 46 years, Kirk & Blum engineers have designed, fabricated and installed thousands of dust and fume control and special air handling systems. With Kirk & Blum you have one source—one responsibility for the entire job.

Kirk & Blum will confer with you on any dust or fume problem you may have. Write: The Kirk & Blum Mfg. Co., 3174 Forrer St., Cincinnati 9, Ohio.

FOR CLEAN AIR . . . THE INVISIBLE TOOL

KIRK AND BLUM

DUST AND FUME CONTROL

new bulletins

(Continued from page 118)

in 4-page leaflet 7226. Applications of the two types are given, together with scale drawings and a chart of approximate dimensions. Ingersoll-Rand Co., Cameron Pump Division.

MATERIALS OF CONSTRUCTION

239—Copper Corrosion

"Corrosion Resistance of Copper and Copper Alloys," 28-page brochure B-36R explains the chemical and physical nature of corrosive attack in its various forms. Tables include the composition, mechanical, and physical properties of copper alloys and typical industrial uses. Corrosion rating charts give relative resistance of principal types of copper and copper base alloys when in contact with 183 different corroding agents. American Brass Co.

MISCELLANEOUS

240—Combustion Data

"Industrial Combustion Data," a 168-page handbook on heat processing applications, gives useful technical data arranged in concise, practical form, and amply illustrated. It will be of interest to those who are concerned with the selection, supervision, operation and maintenance of oil and gas combustion equipment as applied to industrial furnaces, ovens, kilns, driers, heaters, kettles, stills, calciners, and other similar equipment. Hauck Manufacturing Co.

241—Blast Cleaning Machines

Two fundamental methods of applying abrasives with hand-operated, nozzle, blast cleaning machines are appraised in 28-page booklet 100A. In addition, applications for both wet and soft abrasives are discussed. Design features, construction, and operation of various types of blast cleaning hose machines are described. Tables indicate the relationship between orifice area, circumference, nozzle sizes, air flow, and required horsepower. Pangborn Corp.

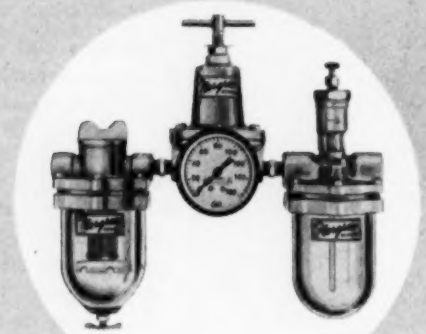
HEATING, AIR CONDITIONING & REFRIGERATION

242—Air Handling Units

Detailed installation possibilities for central plant air conditioning, exhausting heat fumes or vapors, and heating and ventilating requirements where cooling is not needed, are discussed in 6-page booklet 1600. A full line of accessories for air handling units, including humidifiers, mixing boxes, and filter sections is described. Sturtevant Div., Westinghouse Electric Corp.

let **NORGREN** help you

reduce maintenance problems and expense on air-operated equipment



LUBRO-CONTROL UNIT

cleans the air
regulates air pressure
supplies oil-fog lubrication

The Norgren Lubro-Control Unit automatically filters grit, pipe scale and moisture from the air...regulates line pressure of up to 400 psi. to desired working pressure...supplies controlled, air-borne oil fog lubrication to all internal parts of equipment reached by air. It is essential equipment for use in connection with air-operated production machines, air cylinders and air tools on pipe lines from ¼" to 1".

C. A. Norgren CO.
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PIONEER AND LEADER IN OIL-FOG LUBRICATION FOR 25 YEARS

Valves • Filters • Regulators • Lubricators • Hose Assemblies

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FANS & BLOWERS

243—Axial Flow Fans

Discussed in 64-page fan engineering manual 20-a is the theory of fan cooling and characteristics and uses of various types of fans. Tables and graphs give general ventilating requirements, dimensions, and certified ratings for each type of installation. A complete index and table presenting definitions of technical terms are included. Aerovent Fan Co., Inc.

VALUABLE BULLETINS YOU MAY HAVE MISSED

244—Pressure Clamps

Universal pressure clamps which can handle permanent or emergency clamping jobs from ½ in. to 30 ft dia are described in detail in 6-page bulletin 50M. Drawings show how the clamps are applied and where they may be used. A portable repair kit which holds 900 clamps of any diameter in one cubic foot of space is shown. Band-It Co.

245—Spreader Stokers

Reasons for firing with spreader stokers, together with distinctive design and operating characteristics of spreader stoker feeder units, are outlined in the first section of a 46-page brochure. Construction details and advantages of traveling grate units are outlined in a second chapter, and typical installations are presented in a final chapter. Of particular interest are elevation views of the steam generator and stoker, as well as performance data, presented for each case study. Riley Stoker Corp.

—End

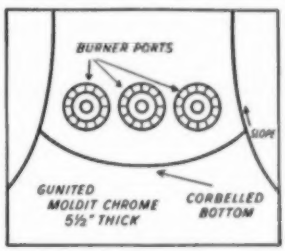
Consolidated Edison finds refractory concrete gives

Low Cover Charge for a Hot Spot

THE FLOOR OF THIS BIG BOILER is literally one of the hottest places in town. Day in and day out it takes terrific punishment as it is baked by flame at temperatures of 2750° to 2800°F. For economy, New York's Consolidated Edison Company tops the floor with 5½ inches of durable refractory concrete. And they save dollars and days from the start!

A castable refractory mix of Lumnite calcium-aluminate cement and aggregate is simply "shot" on by cement gun and reaches service strength in 24 hours or less . . . cutting costly outage.

In service, refractory concrete takes high temperatures and has low volume change to withstand thermal shock. It has excellent abrasion and corrosion resistance as well. So convinced is Consolidated Edison of the economy of refractory concrete that their plans call for building 17 boiler floors this way! **WHEREVER** heat, abrasion, corrosion or thermal shock are problems, you'll find refractory concrete made with Lumnite cement a wise choice. For more information, write Universal Atlas Cement Company, (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.



Refractory concrete for boiler floor is made with Refractory and Insulation Corporation Moldit Chrome Castable, one of the ready-prepared castable mixes of Lumnite cement and aggregate for specific temperature and insulation service available through manufacturers and their distributors. To use—add only water.

"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.

IP-L-72R

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

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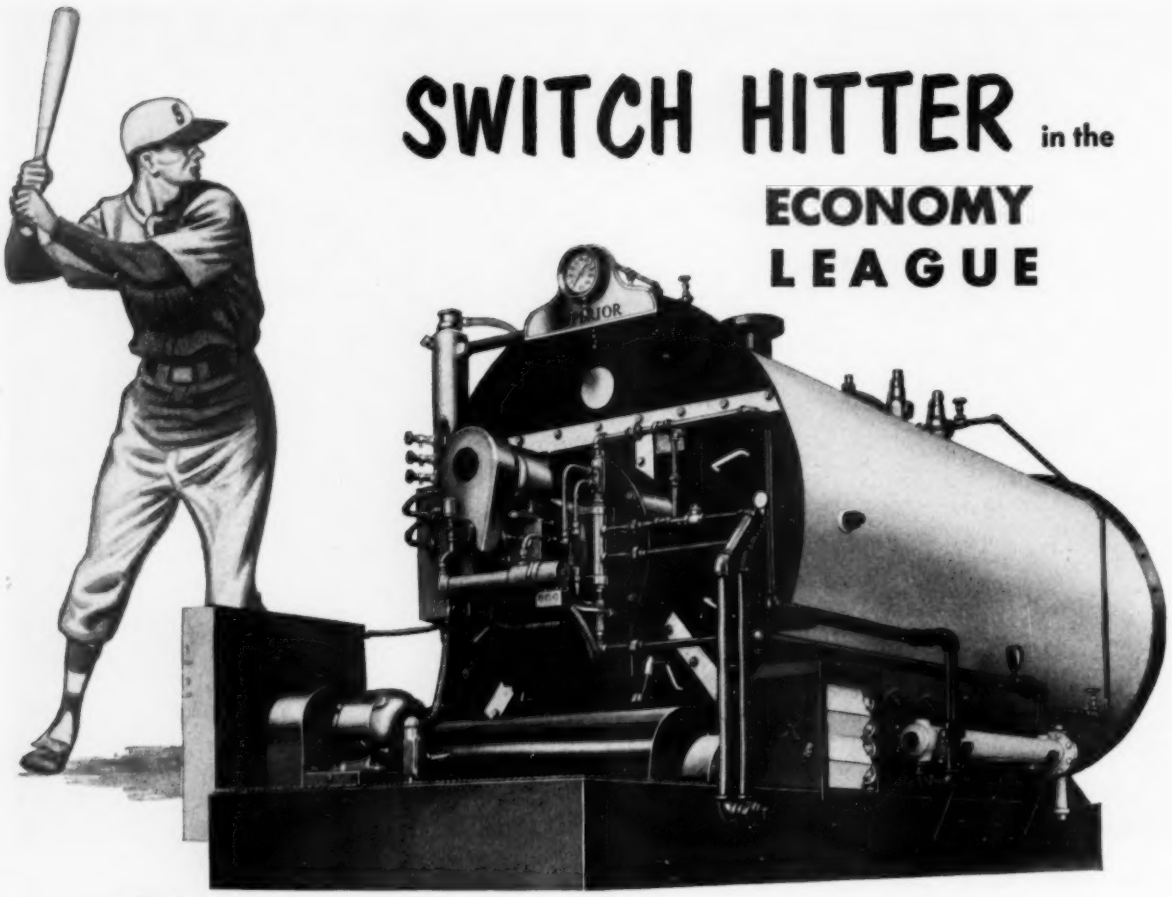

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Co. Address (St. & No.)_____

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readers' guide

. . . to advertised products

AIR FILTERS & DUST COLLECTORS

Key No. 500—Bull 164-3 describes Norblo automatic bag type dust and fume collection. The Northern Blower Co. p 114.

Additional data available on Aerotec electrical precipitators. The Thermix Corp. p 101.

Key No. 501—32 page booklet outlines basic principles of centrifugal dust recovery with Multiclone. Western Precipitation Corp. p 40.

Adv. p 119 contains information on dust and fume control by The Kirk & Blum Mfg. Co.

Cottrell electrical precipitators are described on p 46. Research Corp.

PROTECTIVE COATINGS

Key No. 502—Adv. p 57 contains coupon for complete information on Rust-Oleum coatings. Rust-Oleum Corp.

BOILERS & BOILER ACCESSORIES

Key No. 503—Catalog contains complete data on Prat-Daniel fan stacks. The Thermix Corp. p 103.

Descriptive literature available on Wickes Type A boilers. The Wickes Boiler Co. p 29.

Key No. 504—Bulletin contains data on Powermaster packaged boilers with Voriflow. Orr & Sembower, Inc. p 99.

Adv. p 45 contains information on the John Zink smokeless field flare burner. John Zink Co.

Key No. 505—Bull SW-la contains data on Wing motor-driven, forced draft blowers. L. J. Wing Mfg. Co. p 128.

Advantages of poppet type valves in the Diamond soot blowers are described on p 33. Diamond Power Specialty Corp.

Key No. 506—Catalog 502-F contains complete details on Superior steam generators. Superior Combustion Industries, Inc. p 122.

Information on Enco burners for all grades of liquid fuel described on p 132. The Engineer Co.

Adv. p 58 contains information on coals by Bell & Zoller Coal Co.

Key No. 507—Cat AD-100 contains complete data on standard size oil, gas, combination oil/gas fired boilers. Cleaver-Brooks Co. p 41.

Key No. 508—Coupon on pp 24, 25 offers complete data on Coppus-Dennis Fanmix burners. Coppus Engineering Corp.

Key No. 509—Booklet SB-38T describes Keystone automatic 2-drum water tube boilers. Erie City Iron Works. p 55.

See adv. p 51 for information on Beacon coal. Eastern Gas & Fuel Associates.

Key No. 510—Bull WG-1823 describes Yarway remote liquid level indicators. Yarnall-Waring Co. p 61.

Information on Detroit RotoGrate stokers is described on p 47. Detroit Stoker Co.

Key No. 511—Available folder "All Your Questions Are Answered by Cyclotherm." Cyclotherm Div., U. S. Radiator Corp. p 102.

FW package steam generators are described on p 34. Foster Wheeler Corp.

Key No. 512—Coupon on p 134 offers bulletin on cutting steam costs with Amesteam generators. Ames Iron Works, Inc.

See adv. pp 14, 15 for information on bituminous coal. Bituminous Coal Institute.

Key No. 513—Catalog 501 contains descriptive data on Stowe stokers. The Johnston & Jennings Co. p 107.

BUILDING MATERIALS & MAINTENANCE

Key No. 514—Free Repair Handbook describes Smooth-On repairs. Smooth-On Mfg. Co. p 129.

Key No. 515—Coupon on p 140 offers complete details of trial order plan of floor patch and Handbook of Building Maintenance. Flexrock Co.

Key No. 516—Free sample and data sheet on Fel-Pro C-5 "Hi-Temp" thread compound. Felt Products Mfg. Co. p 131.

Hoffman heavy-duty vacuum cleaning equipment is described on p 131. U. S. Hoffman Machinery Corp.

(Continued on page 126)

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DIESELS & GAS ENGINES

Adv. p 23 contains information on supercharged diesels by The Cooper-Bessemer Corp.

See adv. pp 10, 11 for data on CP diesel, dual fuel and gas engines. Chicago Pneumatic Tool Co.

ELECTRICAL EQUIPMENT

Key No. 517—Catalogs contain data on the application of dry-type transformers. Acme Electric Corp. p 137.

Key No. 518—I-T-E metal-clad switchgear is described in Catalog Sec. 7000. I-T-E Circuit Breaker Co. pp 20, 21.

Key No. 519—Coupon on pp 30, 31 offers complete facts on Fusetron dual-element fuses. Bussmann Mfg. Co.

Adv. p 60 describes steam turbine generators by Worthington Corp., Steam Turbine Div.

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Key No. 520—Price list and catalog available on "Economy De-Lay" Renewable fuses. Economy Fuse & Mfg. Co. p 56.

Key No. 521—Data on circuit breakers offered in Bull 3101. Heinemann Electric Co. p 26.

New G-E White rigid steel conduit is described on p 96. General Electric Co., Construction Materials Div.

ENGINES & TURBINES

Key No. 522—Bull 4206 contains vital facts and figures on De Laval HCB single stage turbines. De Laval Steam Turbine Co. p 44.

Key No. 523—Data on Terry solid-wheel turbine are contained in Bull S-116. The Terry Steam Turbine Co. p 95.

FILTERS, STRAINERS, & PURIFIERS

Key No. 524—Coupon on p 113 offers bulletin on Cuno Micro-Klean filters. Cuno Engineering Corp.

HEAT EXCHANGER EQUIPMENT

Adv. p 115 contains information on all types of deaerating equipment. Cochrane Corp.

HOW TO REQUEST FREE LITERATURE

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Key No. 525—Coupon on p 129 offers booklet on Pick instantaneous water heaters. Pick Mfg. Co.

Key No. 526—Typical installations of Vogt film type exchangers are described in Bull HE-7. Henry Vogt Machine Co. p 42.

HEATING, AIR CONDITIONING & REFRIGERATION

Key No. 527—Catalogs CUH-846-A & BC-1049 contain complete data on Grid unit heaters and blast coils. D. J. Murray Mfg. Co. p 136.

Key No. 528—Bull DS-327A contains data on Trane Torridors for packaged heating, ventilating and air filtering unit. The Trane Co. p 36.

Key No. 529—Complete information available on Niagara absorbent spray method for solving air conditioning problems. Niagara Blower Co. p 110.

INSTRUMENTS & CONTROLS

Key No. 530—Details available on Liquidometer tank gage. The Liquidometer Corp. p 129.

Key No. 531—Bull 148 B.P. contains data on Cambridge dissolved oxygen

(Continued on page 128)

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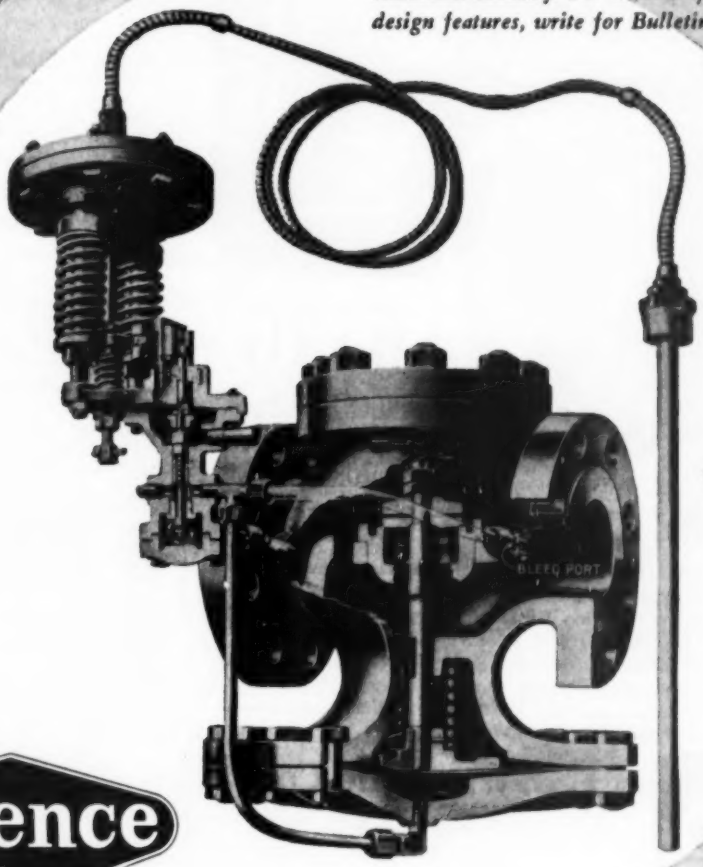

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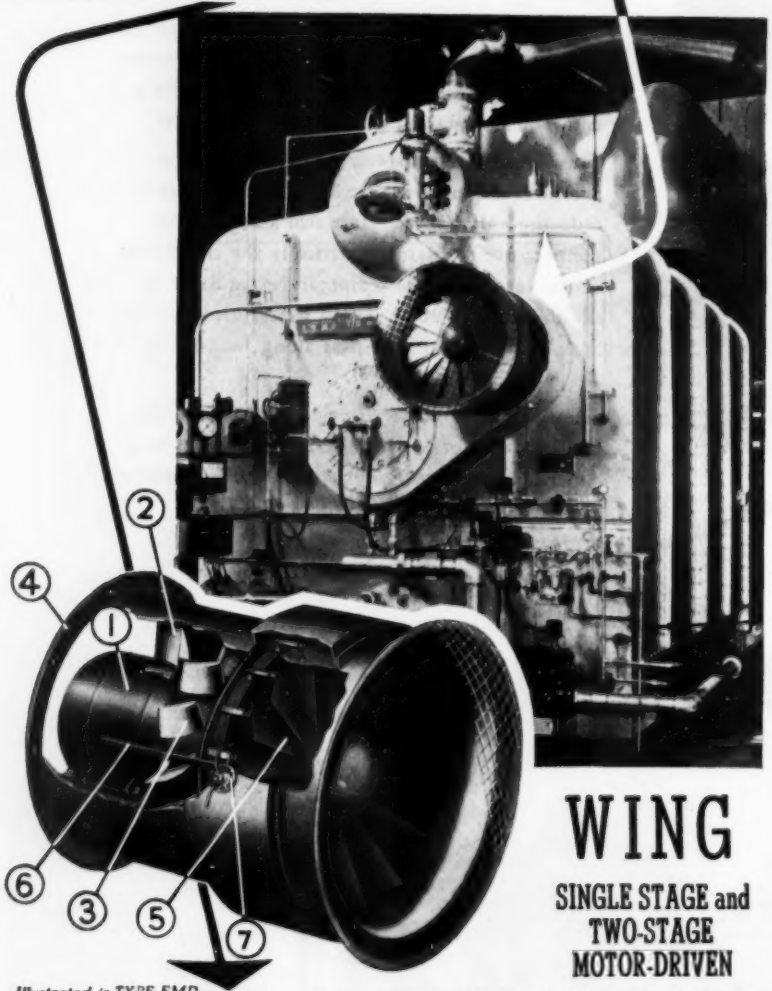

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139 Vreeland Mills Road
Linden, New Jersey

Factories: Linden, N.J. and Montreal, Can.

readers' guide

(Continued from page 126)

recorder and dissolved hydrogen recorder. Cambridge Instrument Co., Inc. p 135.

Information is available on tubeless magnetic amplifier DC supplies for automotive and aircraft industries. Sorensen & Co. p 32.

Key No. 532—Catalog gives information on Auto-Lite temperature indicators and recorders. The Electric Auto-Lite Co. p 139.

Key No. 533—Bull CA-8R describes Mercoid relay for audible alarm. The Mercoid Corp. p 135.

LUBRICANTS & LUBRICATION EQUIPMENT

Key No. 534—Instructive bulletin and free testing sample of Non-Fluid Oil. New York & New Jersey Lubricant Co. p 130.

Texaco Ursa oils are described on p 142. The Texas Co.

Adv. p 43 contains data on Gascon and Rubilene oil for diesel lubrication. Sinclair Refining Co.

HOW TO REQUEST FREE LITERATURE

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Key No. 535—Literature describes complete line of Hilco purifiers, filters, reclaimers and conditioners. The Hilliard Corp. p 108.

Adv. p 120 describes Norgren Lubro-Control unit that cleans air, regulates air pressure and supplies oil-fog lubrication. C. A. Norgren Co.

Nonpareil turbine oil is described on p 59. Standard Oil Company.

Key No. 536—"Lubriplate Data Book," . . . a valuable treatise on lubrication. Lubriplate Div., Fiske Brothers Refining Co. p 132.

MATERIALS HANDLING EQUIPMENT

Book 2410 shows latest equipment and system layouts for power plants large and small. Link-Belt Co. p 3.

MECHANICAL POWER TRANSMISSION

Key No. 537—Bull 6808 describes R/M Condor V-belts. Raybestos-Manhattan, Inc., Manhattan Rubber Div. p 37.

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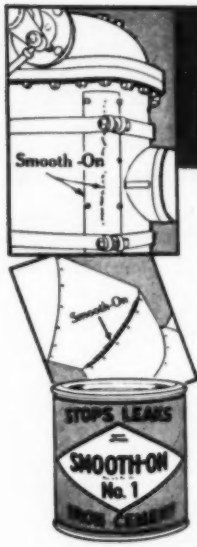

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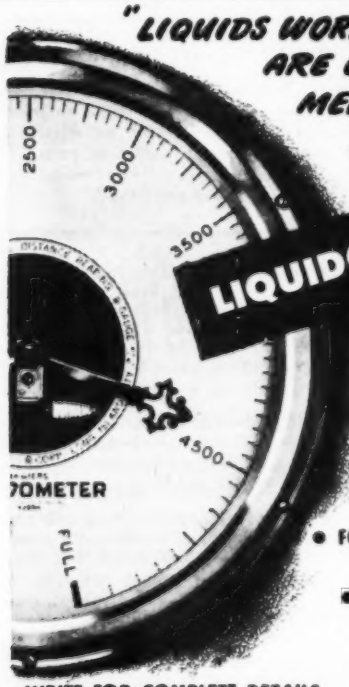

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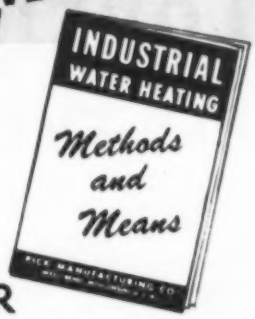

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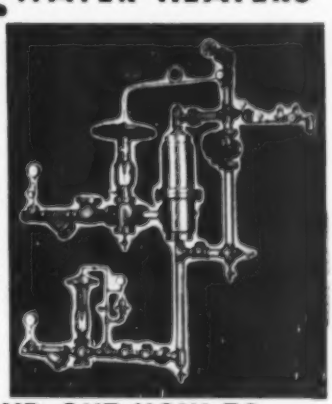

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readers' guide

(Continued from page 128)

Key No. 538—Descriptive literature available on Lovejoy Universal joints. Lovejoy Flexible Coupling Co. p 130.

Key No. 539—Basic Dynamatic units for adjustable speed drive problems are described in Bull GB-1. Dynamatic Corp. p 35.

PACKING & GASKETS

Adv. p 54 contains information on R/M's Big 7 packing types. Raybestos-Manhattan, Inc., Packing Div.

Ajax Spiralwound gaskets are described on p 118. United States Gasket Co.

Key No. 540—Illustrated catalogs describe Crane packings for all power plant services. Crane Packing Co. p 126.

J-M packings are described in adv. p 38. Johns-Manville Corp.

PIPE, TUBING, & HOSE

Key No. 541—Complete description and enlarged diagram of Piping Layout No. 68 available. Jenkins Bros. p 9.

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Key No. 542—Available bulletin "The ABC's of Wrought Iron" with complete data. A. M. Byers Co. p 53.

Adv. p 140 contains data on Ric-wiL prefabricated insulated piping. The Ric-wiL Co.

Key No. 543—Cat 500 contains data on seamless & interlocking hose in bronze, steel & stainless steel. Atlantic Metal Hose Co. p 139.

Key No. 544—Hanger Catalog contains complete data on adjustabe pipe hangers and supports. Grinnell Co., Inc. p 4.

PUMPS & COMPRESSORS

Key No. 545—Bull 5313 contains full details on Schramm Super-Unistage air compressors. Schramm, Inc. p 109.

Key No. 546—Bulletin contains illustrated technical data on the H-20 controlled volume pump. Milton Roy Co. p 111.

(Continued on page 132)

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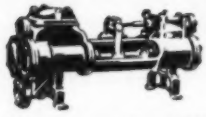

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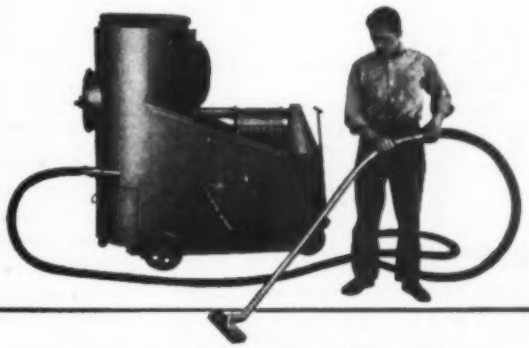


YOUR CHOICE OF 4 BIG-CAPACITY PORTABLES

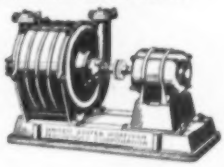
Advanced design and construction features for fast, efficient cleaning, with one-man handling. 1½, 3, 5, and 7½ H.P. models to match your specific cleaning requirements

STATIONARY SYSTEMS IN A WIDE RANGE OF SIZES TO FIT YOUR MAINTENANCE OR PRODUCTION OPERATIONS

Provides cleaning in several areas at the same time. Sweepers attach cleaning hose to conveniently located inlets (in a permanently piped system). Dust is removed pneumatically to central collectors for easy disposal.

MULTISTAGE CENTRIFUGAL BLOWERS AND EXHAUSTERS

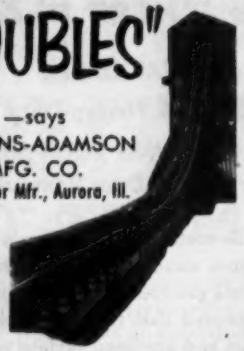
For agitation of liquids, combustion, mixing—for all air requirements (including the elimination of compressed air). No internal moving parts. Low power consumption. Adopted as standard in steel plants, textile and ice plants requiring 24-hour continuous service. Wide range of pressures, capacities and vacuum, for air or gas. Tell us your requirements.



AIR APPLIANCE DIVISION
U.S. HOFFMAN MACHINERY CORPORATION
108 EAST 12th STREET, NEW YORK 3, N.Y.
CANADIAN PLANT CANADIAN HOFFMAN MACHINERY CO. LTD. NEWMARKET ONT.

"NO MORE LUBRICATION TROUBLES"

—says STEPHENS-ADAMSON MFG. CO.
Conveyor Mfr., Aurora, Ill.



"LUBRIPLATE Lubricants satisfy the 'one-shot' requirements of our conveyor idlers. LUBRIPLATE effectively lubricates each bearing in turn and flows through the hollow shaft to the next bearing. We do not know of a single case of bearing trouble through faulty lubrication where LUBRIPLATE has been used."

For nearest LUBRIPLATE distributor, see Classified Telephone Directory. Send for free 56-page "LUBRIPLATE DATA BOOK"... a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

readers' guide

(Continued from page 130)

Key No. 547—Johnston close-coupled, vertical turbine pumps are described in Bull H-93. Johnston Pump Co. p 106.

Heavy-duty "ES" compressors are described on p 49. Ingersoll-Rand.

REFRACTORIES

Information available on Lumnite for refractory concretes. Lumnite Div., Universal Atlas Cement Co. p 121.

Key No. 548—Adv. p 116 offers free sample bag of Stic-Tite insulating cement. Refractory & Insulation Corp.

STEAM SPECIALTIES

Key No. 549—Bull 275-4 gives complete information on Sarco thermostatic air vents. Sarco Company, Inc. p 141.

Key No. 550—Bull T-1740 contains data on Yarway Impulse steam traps. Yarnall-Waring Co. p 62.

HOW TO REQUEST FREE LITERATURE

Insert "key" numbers on return post card found on page 123. For quick reference to free literature offered by advertisers in this issue, refer to listing on page 134. Our Reader's Service Department will handle your request promptly.

Key No. 551—Bull 223, "Vacuum Isn't Vacuum," describes steam traps for vacuum return service. Armstrong Machine Works. p 2.

Key No. 552—Adv. p 112 offers catalogs: traps—600; separators—500; boiler trim—700. Wright-Austin Co.

Key No. 553—Cat 751 describes Nicholson expansion steam traps. W. H. Nicholson & Co. p 137.

TOOLS

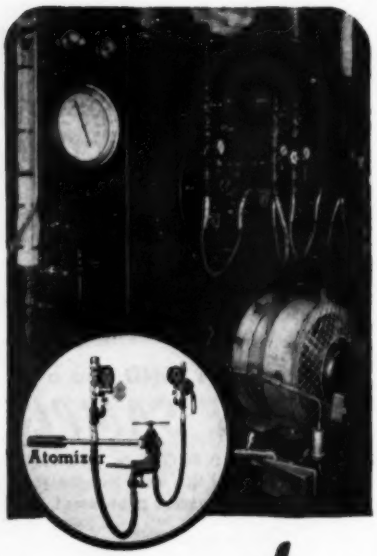
Key No. 554—Bull 54 describes Airetool retractive expansion system. Airetool Mfg. Co. p 133.

Key No. 555—Coupon on p 135 offers free literature on masonry and concrete saws. Clipper Mfg. Co.

Key No. 556—Send 10c for 68-page catalog of Proto tools. Proto Tools. p 6.

VALVES & REGULATORS

Key No. 557—Coupon on p 26 offers literature on Fig. 444-8 series all-purpose forged steel valves. Edward Valves, Inc.



Efficient combustion with

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FOR ALL GRADES OF LIQUID FUEL

Enco Burner Units of Steam or Mechanical Atomizing Types are made in various sizes with capacities from 1 to 1000 gallons per hour.

Designed for operation either with or without air registers and for natural or forced draft.

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Enco Atomizers are used with various types and makes of pulverized-coal and gas-burner units to provide a dual fuel unit for cold starting, or for full-load operation when coal or gas is not available, or use when oil is the more economical fuel.

We have made many installations during the past 25 years and are ready to cooperate with those looking for better operation and assurance against loss of steam output.

THE ENGINEER CO.
Enco 75 West St. New York 6, N. Y.

readers' guide

Adv. pp 18, 19 describes Powers packless convector and unit control valve. The Powers Regulator Co.

Key No. 558—Full details on Spence temperature regulators is given in Bull T50. Spence Engineering Co., Inc. p 127.

Adv. p 139 contains information on all types of Rockwell valves with manual or automatic control. W. S. Rockwell Co.

Key No. 559—Bull 511-A with complete capacity tables describes the Leslie small flow reducing valve. Leslie Co. p 105.

Key No. 560—Catalog describes reduction of repairs with Sims pump valves. Sims Pump Valve Co., Inc. p 131.

Key No. 561 — Catalog 10 describes Chapman List 900 forged steel gate valves. The Chapman Valve Mfg. Co. p 48.

Crane diaphragm valves are described on p 7. Crane Co.

Key No. 562 — Descriptive literature available on Darling revolving disc gate valves. Darling Valve & Mfg. Co. p 52.

WATER TREATMENT & WASTE DISPOSAL

Adv. p 13 contains information on the Nalco system of water treatment. National Aluminate Corp.

Adv. p 50 contains information on the Sphericone hot process water softener. Graver Water Conditioning Co.

Key No. 563—Bulletins available on manual or automatic water treatment plants. Hungerford & Terry, Inc. p 137.

Adv. p 28 contains information on American demineralizers for the treatment of boiler feedwater. American Water Softener Co.

Key No. 564—Bull 1105 contains data on new, self-contained chemical feed pump. % Proportioneers, Inc.% p 39.

Adv. p 117 describes Bird-Archer's 8 point water treatment service. The Bird-Archer Co.

Key No. 565—Technical Bull No. 124 describes Betz filming amine treatment. W. H. & L. D. Betz. p 17.

Key No. 566—Coupon on p 104 will bring complete details on the Chlorinizer slime control system. Builders-Providence, Inc.

—End

NOW

Roll tubes into thick tube sheets automatically! . . . from the inside out! with the

NEW AIRETOOL RETRACTIVE EXPANSION SYSTEM

Advantages? *just check them!*

- √ Draws tube metal toward mouth, eliminates inward elongation.
- √ Each joint rolled automatically to predetermined tightness.
- √ Eliminates slow, costly steprolling.
- √ Continuous process rolling shortens rolling time.
- √ Tube sheets protected against distortion, enlargement of holes.

With this new Retractive Method of Tube Expansion, the expander is fully inserted and rolls a short section of the tube. When full expansion is reached, it then automatically starts to retract. Keeps rolling as it retracts, gives full expansion to the tube the entire thickness of the sheet.

To learn more about this efficient new Retractive Method of expanding high pressure tubes—write for your copy of AIRETOOL Bulletin No. 54.

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There's an AIRETOOL Tube Cleaner and Tube Expander for Every Type of Tubular Construction.

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Representatives in principal cities of U.S.A., Canada, Mexico, South America, England.

20 SIZES...
10 to 600 h.p...
15 to 200# OIL OR GAS

AMESTEAM GENERATOR

This automatically controlled packaged boiler unit includes:

★ all piping and wiring, ready for your service connections.

★ fan, feed water pump, condensate tank, injector, blow-off valve, necessary refractories, insulation and metal jacket.

ALL YOU NEED is fuel tank, gas vent and service connections.

—AND YOU KEEP RIGHT ON SAVING with these trouble-free, fully automatic units with their eye-level controls, their accessibility inside and out, and fuel-saving 80% guaranteed efficiency!

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Builders of Better Boilers Since 1848

quick reference

to bulletins & catalogs

Page No.	Advertiser	Catalog	Key No.
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134	Ames Iron Works, Inc.	Amesteam generators	512
2	Armstrong Machine Works	"Vacuum Isn't Vacuum"	551
139	Atlantic Metal Hose Co.	Flexible metal hose	543
17	Betz, W. H. & L. D.	Amine treatment	565
104	Builders-Providence, Inc.	Chlorinizer slime control system	566
30	Bussmann Mfg. Co.	Dual-element fuses	519
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113	Cuno Engineering Corp.	Micro-Klean filters	524
52	Darling Valve & Mfg. Co.	Revolving disc gate valves	562
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35	Dynamatic Corp.	Electro-magnetic equipment	539
56	Economy Fuse & Mfg. Co.	"Economy Delay" renewable fuses	520
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114	Northern Blower Co., The	Dust and fume collection	500
99	Orr & Sembower, Inc.	Powermaster with Voriflow	504
129	Pick Mfg. Co.	Instantaneous water heaters	525
103	Prat-Daniel Corp.	Fan stacks	503
39	%Proportioneers, Inc.%	Chemical feed pump	564
6	Proto Tools	Proto tools (send 10¢)	556
37	Raybestos-Manhattan, Inc. Manhattan Rubber Div.	Condor V-belts	537
116	Refractory & Insulation Corp.	Insulating cement	548
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141	Sarco Company, Inc.	Thermostatic air vents	549
109	Schramm, Inc.	Air compressors	545
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128	Wing Mfg. Co.	Blowers	505
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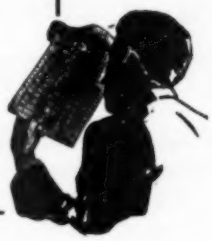
NOTE—List "Key Numbers" on the postal card on page 123

PREVENT BOILER CORROSION



Oxygen dissolved in boiler feed water which is a very active source of destructive boiler corrosion may be continuously detected and recorded by the Cambridge Gas Analyzer. The oxygen dissolved in the feed water is determined directly, and continuously recorded upon the Cambridge Dissolved Oxygen Recorder. The oxygen set free by dissociation in the boiler is determined by measuring the free hydrogen in the steam which is recorded upon the Cambridge Dissolved Hydrogen Recorder. Cambridge Analyzers are available in models for continuously recording either O_2 or H_2 separately or O_2 and H_2 simultaneously.

Send for Bulletin 148 B.P.

CAMBRIDGE INSTRUMENT CO., INC.

3060 Grand Central Terminal New York 17, N. Y.

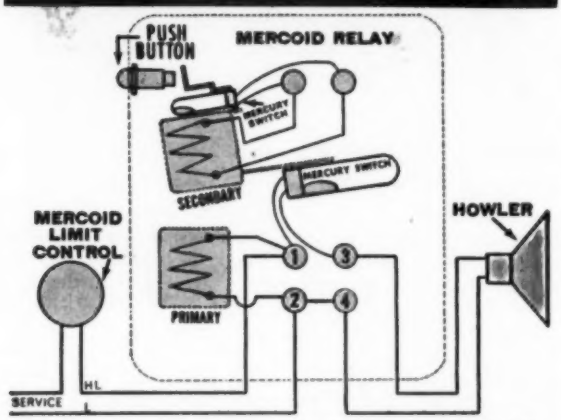
CAMBRIDGE

DISSOLVED O_2 & H_2

ANALYZERS

PIONEER MANUFACTURERS OF PRECISION INSTRUMENTS

MERCOID RELAY FOR AUDIBLE ALARM

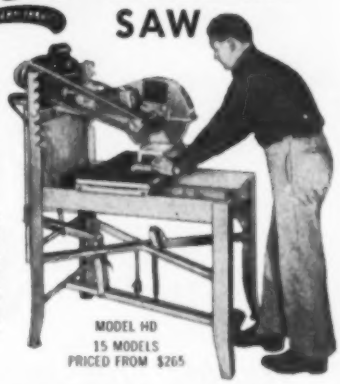


When Limit Control closes its circuit, current is supplied to primary coil of Mercoid Relay and through the normally closed mercury switch to the "Howler" (alarm). To stop "Howler," operator pushes in "push button" which manually raises relay secondary and breaks circuit to "Howler." Secondary is held up by magnetic repulsion until condition is corrected. When limit control opens the primary circuit of relay, secondary coil drops to normal position and relay is automatically ready for another operation.

WRITE FOR BULLETIN CA-8R

THE MERCOID CORPORATION 4201 BELMONT AVE., CHICAGO, ILL.

Clipper® **MASONRY SAW**



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Every shape and size refractory **cut in seconds.** Perfect fitting reline jobs that last longer—cost less. And Clipper's Patented Features give you DUSTLESS cutting, instant Portability and complete Flexibility.

Nearly 20 Years Experience Behind GENUINE CLIPPER PRODUCTS

The unqualified Clipper guarantee of satisfaction is backed by world-wide experience, the ability to select the finest materials and the "know-how" to put them together.

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You are GUARANTEED ECONOMY with CLIPPER SUPERIOR BLADES!

. . . all specifications of Abrasive, Diamond and "CBR" (Break-Resistant) Blades guaranteed to "Consistently Provide the fastest cut . . . at the lowest cost . . . with the greatest ease!"

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Discover how Clipper will increase profits by increasing production at reduced costs. "ON THE JOB" FREE TRIAL guarantees satisfaction at NO OBLIGATION.

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PRESSURE EQUALIZER
Automatically Cushions Blade for Longer Life.

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Instant Adjustment for Any Size Material.

Clipper® NATION-WIDE DIRECT FACTORY SERVICE

SAVE BY SAWING REPAIR PATCHES and TRENCHES

IN FLOORS—RUNWAYS —STREETS with a CLIPPER "CONSAW"
5 MODELS—GAS OR ELECTRIC POWERED

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Put up to Stay up!

trouble free service for over 22 years...that's only one record for...

GRID UNIT HEATERS

That's the experience of a large midwest manufacturer. Twenty-two years of service without need for repairs prove to him that, with a GRID installation, first cost is last cost. Such service records (GRID installations made in 1929 are still operating) are the rule rather than the exception with GRID Unit Heaters because GRID was deliberately designed to be a better unit heater. To provide not only ample, comfortable heat, but to give years of service without the usual high maintenance cost generally experienced with ordinary unit heaters.

Such service records occur because GRID is completely different from other unit heaters — here's how:

GRID is an all cast unit with finned heating sections and headers tested to withstand steam pressures up to 250 # P.S.I.

GRID construction uses no brazed, soldered, rolled or welded connections between condenser and headers. A specially designed threaded nipple assures a precision, leak-proof fit.

GRID construction has all similar metals in contact with steam, thus preventing electrolytic corrosion which eventually occurs in copper type unit heaters where steam passes from iron pipes into copper cores. (Write for booklet CORROSION IN UNIT HEATERS.)

GRID construction resists corrosion from fumes present in most types of industry.

GRID design incorporating low outlet temperatures, proper fan sizes and motor speeds, assures delivery of warm comfortable air in ample volume to the working level. No stratification of warm air at the ceiling to waste your fuel dollars.

These are the reasons why users of GRID Unit Heaters get 22 years and more of trouble-free service. There are units cheaper than GRID, but there is none better. You start saving money the day you install GRID Unit Heaters.

GET THE COMPLETE GRID STORY — WRITE FOR CATALOG CUH-846-A.

GRID Blast Coils are ideal for process drying — write for Catalog BC-1049.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

D. J. MURRAY MANUFACTURING CO.
MANUFACTURERS SINCE 1883 WAUSAU• WIS.

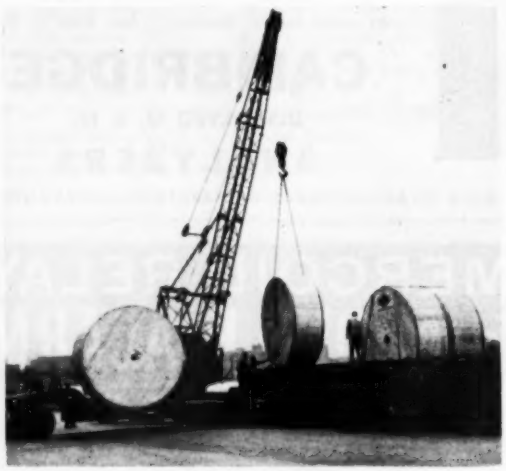
spot news

(Continued from page 104)

Rubber Belt Retired After 64 Years

One of the first cotton duck and rubber belts to be used for industrial hauling has finally been retired. The belt has seen 64 years of continuous use by a Minnesota grain concern. Made in 1889 by New York Belting and Packing Co., this is the longest known record of service for an industrial rubber belt. Previously, belts had been constructed of leather or woven fabrics.

Although the belt apparently had several years of useful service left, officials of the grain company decided to replace it while major construction changes were being made in one of their elevators. The 24 in. wide belt will be sent back to the manufacturer's Passaic plant to undergo extensive laboratory tests.



Belting for Rubber Railroad Shipped in Huge Rolls

Shipment of 14 rolls of conveyor belting, weighing 25,000 lb each, is being made by Goodyear Tire & Rubber Co. to a Texas customer. The belt is being rolled and shipped in 2000 ft lengths to assure ease of installation at the conveyor site.

The 28,000 ft of 42 in. wide conveyor belt in 12 ft dia rolls will be followed by 7000 ft of 36 in. wide belt to complete an eight-flight system, more than three miles long, which will carry lignite from a strip mining field to a power plant near Rockdale, Texas.

At the strip mine site, belts will be cradled on a bar and pulled out on the roller bed like ribbon from a spool. Goodyear crews will splice the belt together on the job.

The belting, constructed of specially-compounded cold rubber and fabric, will be required to carry a top capacity load of 2 million pounds of lignite an hour at 550 fpm over the conveyor way. Operation of the belt system will require 950 hp, generated from eight motors.

—End

This Large Firm Adopts $35 Nicholson Traps as Temperature Controls

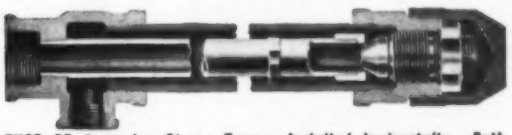
Because they serve effectively as temperature controls as well as steam traps, and costing only about $35, Nicholson expansion steam traps are being increasingly installed in place of temperature regulators. A large processor recently installed these Nicholson units on outdoor storage tanks after thorough tests showed a less than 2°F variation in outlet condensate temperature. Regulators had been costing them $110.00 to $200.00, with cost of a trap added.

Nicholson expansion steam traps are easily adjusted to pass condensate at any temperature below 212°F. Because there is only one moving part, remarkably low maintenance costs are being shown. Easily installed, usually without supports. Lengths, 9" to 40". Pressure 0 to 250 lbs. Freezeproof.

For All Equipment Using Steam or Hot Water

Absorption Stills	Heavy Oil Tanks	Separators
Cookers	Molding Presses	Steam Stills
Dry Kilns	Pipe Coils	Sterilizers
Evaporators	Preheat Tanks	Switch Heaters
Gas Holders	Railway Coaches	Tracer Lines
Heat Exchangers	Retorts	Wax Tanks

Catalog 751



TYPE RF Expansion Steam Trap — Installed horizontally. Both types are for steam or hot water; pressure to 250 lbs.

TYPE SF—Installed horizontally or vertically without supports.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

135 OREGON ST., WILKES-BARRE, PA.

Representatives, in 58 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

USE ACME ELECTRIC DRY-TYPE TRANSFORMERS TO

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- OPERATE 120 VOLT EQUIPMENT FROM POWER CIRCUITS
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- BALANCE VOLTAGE
- INSULATE CIRCUITS

Available in sizes 1/10 to 167 KVA, 1 phase 60 cycle; 9 KVA to 500 KVA 3 phase 60 cycle. Class "A" and Class "B" insulation.

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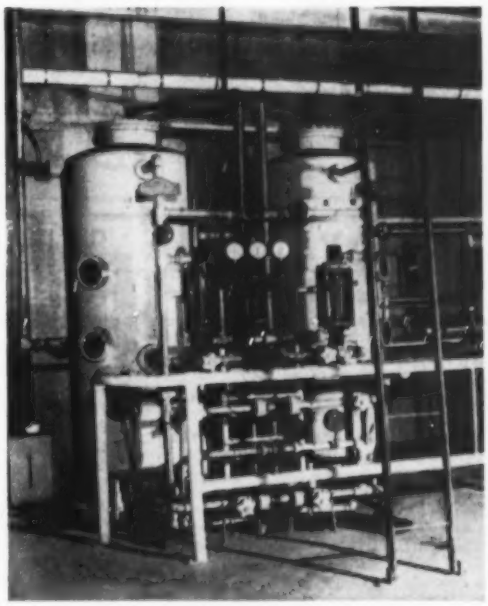
529 WATER STREET • CUBA, N. Y.

Acme ACME Electric
TRANSFORMERS



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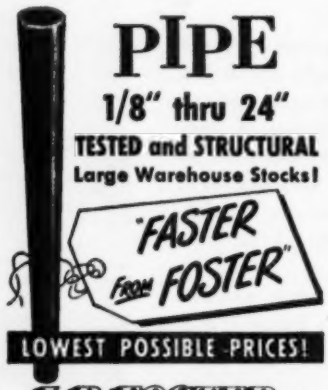

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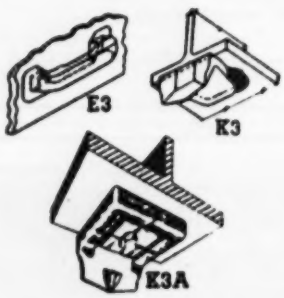

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Auto-Lite offers many thermometer styles, permitting plant-wide temperature observation at low cost. Standard temperature ranges from minus 60°F to plus 750°F. Send for latest catalog showing various types.

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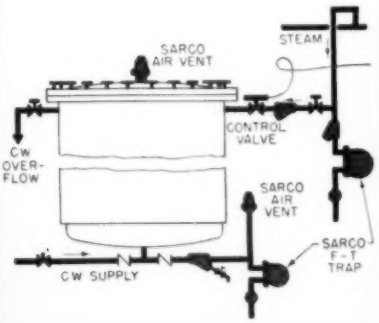
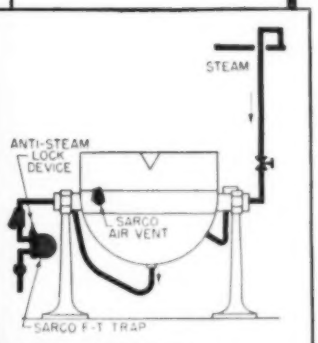
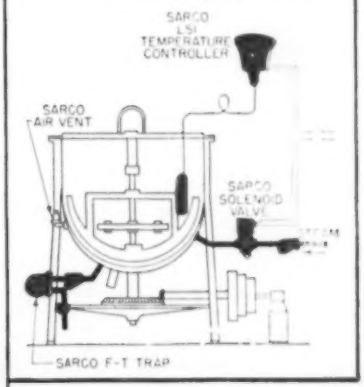
1 CANNING RETORT — down flow steam improves air venting. Draining and air venting automatically with Sarco equipment.





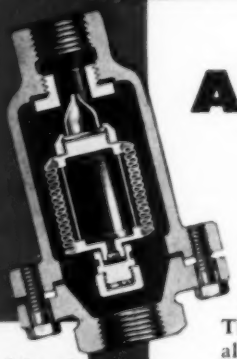
QUICK BOILING TILTING KETTLE — rapid air venting and draining with Sarco controls. **2**

3 JACKETED MIXER — the Sarco Automatic System quickly removes air and condensate, holds the temperature constant.



quick AIR VENTING

increases efficiency of process equipment



● Sarco Balanced Pressure Thermostatic Air Vent, type VS, sizes ⅜" to 1¼", pressures to 225 psi. Very large capacities.

● AIR in steam spaces cannot supply useful heat. The temperature of a mixture of air and steam is always lower than that of pure steam at the same pressure. So air in steam has the same effect as reducing the operating steam pressure.

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Sarco Thermostatic Air Vents . . .

are expressly designed to rid all types of process equipment of air and non-condensables and keep them that way.

When starting up, the large discharge valve is wide open, providing rapid and complete discharge of initial air. Air which collects during operation is discharged promptly, regardless of steam pressure or temperature.

For full information on where and how to apply air vents to speed production and save fuel, write for Bulletin 275-4.

● Sarco type VS Thermostatic Air Vents on ends of steam tubes of rotary drier.

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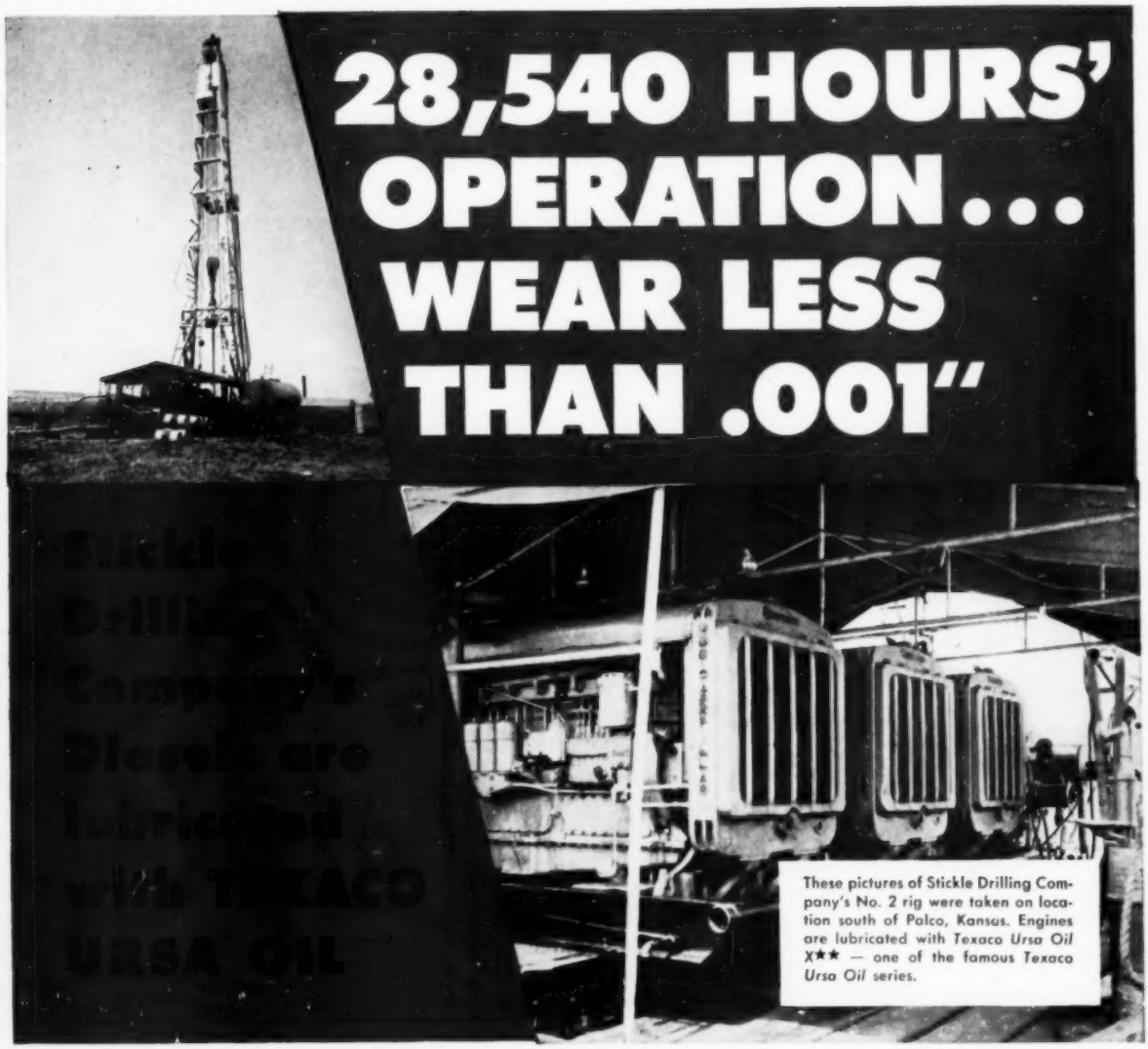
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